Resource Reserves Verification Report of Dongduimiangou Gold Mine in Aohan Banner, Inner Mongolia Autonomous Region

China Nonferrous Metal Geological Survey Co., Ltd.

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1 Preface

1.1 Overview

1.1.1 Objective

According to the requirements for "resource reserves verification of Dongduimiangou Mine Field" made by China Nonferrous Metal Geological Survey Co., Ltd. and Xinruien Mining Co., Ltd. in Aohan Banner, Inner Mongolia, entrusted by Xinruien Mining Co., Ltd., China Nonferrous Metal Geological Survey Co., Ltd. verified mineral resource reserves of this mine so as to provide geological and resource reserves basis for rational resource development. The closing date of resource and reserve verification is the end of December, 2009.

Mining license of Xinruien Mining Co., Ltd. in Aohan Banner is numbered T15120080502007822 and is valid from May 16, 2009 to January 16, 2011, and the exploration area is 2.07Km^2. Mining elevation is +833m to +505m and gold ore will be mined. Underground mining with vertical and inclined shafts + adit is adopted. The designed productive capacity is 30,000t/a.

1.1.2 Tasks and Requirements

This project can be divided into 2 parts:

(1) Controlled Orebodies being Developed:

1. Basically identify the strata, structure, magma and metallogenic geological condition of mine field.

2. Verify the morphology, scale, occurrence, thickness and variation in grade by using available geologic data and applying geological survey, engineering survey, sampling, testing and other technical means, and basically identify the texture, structure, composition and processing performance of ore. Verify the measured resource reserves and retained resource reserves by the end of December 2009.

(2) Orebody Newly Found during This Work:

1. Find the orebodies with great potential for general investigation through reconnaissance geological survey method, disclose and verify them through geologic mapping and drilling engineering, correlate adjacent area with similar geological characteristics - Jinchanggouliang Gold Mine, and provide mineralized bodies for general investigation.

2. Primarily understand the morphology, occurrence and quality characteristics of orebodies.

3. Primarily estimate the resource reserves of mineralized bodies.

4. Implement the sparse engineering control and exploratory drilling survey of newly-found orebodies.

1.1.3 Verification Basis

1. 1:50000 regional geological survey conducted by the 3rd Geological Brigade of Inner Mongolia Bureau of Geology and Mineral Resources in 1988 to 1990

2. Geological memoirs of Inner Mongolia Autonomous Region

3. Report on Detailed Exploration of Dongduimiangou Gold Mine Field in Aohan Banner, Inner Mongolia Autonomous Region submitted by Inner Mongolia Tianxin Geological Exploration and Development Co., Ltd. in May 2008

4. Exploration License (license No.: T15120080502007822) of Chifeng Guojin Mining Co., Ltd. issued by the Land and Resources Department of Inner Mongolia Autonomous Region in May 2008

5. Classification of Solid Mineral Resources/Reserve (GB/T17766-1999)

6. General Requirements for Solid Mineral Exploration (GB/T13908-2002)

7. Specifications for Hard-rock Gold Exploration (DZ/T0205-2002)

8. Exploration Specification of Hydrogeology and Engineering Geology in Mining Areas (GB12719-91)

9. Notice on the Specifications for Solid Mineral Resources Reserve Verification Report Compilation (GUOTUZIFA [2007] No.26)

1.1.4 Location and Traffic

The mine field is 3km (4km for haul distance) away from the southeast of Jinchanggouliang Township government, 50km (linear distance) (75km for haul distance) away from Xinhui Township where the government of Aohan Banner lies, and 45km (linear distance) (85km for haul distance) away from Zhaoyang City with railway to the south. They are connected to each other by provincial (municipal) highway (see traffic and location map 1-1) and have very convenient traffic.

The geographic coordinates of verification area:

East Longitude: 120°17′45″--120°19′15″

North Latitude: 41°57′15″--41°58′15″

The mining area is delineated by 10 inflection points and their coordinates are listed in table 1-1.

Table 1-1 Exploration License, Detailed Exploration and Coordinates of Inflection Points

Inflection Point No.	Coordinate		3° GK Zone of Rectangular Coordinate		6° GK Zone of Rectangular Coordinate	
	East Longitude	North Latitude	X	Y	X	Y
1	120°17′45″	41°57′45″	4647596	40524525	4651092.5	21275814
2	120°18′45″	41°57′45″	4647600.9	40525907	4651049	21277195
3	120°18′45″	41°58′15″	4648526.5	40525903	4651974.7	21277224
4	120°19′15″	41°58′15″	4648529.1	40526594	4651953	21277915
5	120°19′15″	41°57′45″	4647603.5	40526597	4651027.3	21277886
6	120°19′00″	41°57′45″	4647602.2	40526252	4651038.1	21277541
7	120°19′00″	41°57′30″	4647139.4	40526254	4650575.3	21277526

8	120°18′45″	41°57′30″	4647138.1	40525908	4650586.1	21277181
9	120°18′45″	41°57′15″	4646675.3	40525910	4650123.2	21277166
10	120°17′45″	41°57′15″	4646670.4	40524528	4650166.7	21275784

1.1.5 Physical Geography

The mine field lies in branch range of Nuluerhu Mountains, belongs to low mountainous area moderately incised, and has the elevation of 875m to 550m and relative height difference of 325m (100-210m for the typical). Some low-lying place where the rock crops out in the mine field is covered with Quaternary System.

There is no permanent flow in the mine field and peripheral area. It mainly rains in July and August and temporary flood flow is formed.

The mine field lies in frigid alpine mountain area, had the diurnal amplitude of up to 15℃ and annual mean temperature of 5.3~7.2℃ and is cold in winter. It has the lowest temperature of -30.7℃(December 2006) and moderate temperature in summer. It has the highest temperature of up to 37.5℃ in July 2007. The area has the annual precipitation of 218.3-480.1mm and annual evaporation capacity of 2220.9-2920.8mm. It seldom snows in winter and blows northwest wind in spring and autumn. It blows over 6-level gale annually for 69 days. Heavily windy day mainly occurs in April and May. The annual mean wind-speed is 4.8m/s and the maximum wind-speed id 30m/s. The mine field belongs to temperate continental monsoon climate. Frost period is from early October to late April of next year and lasts for only 5 months. The annual maximum depth of frozen ground is 147cm.

According to Seismic Ground Motion Parameter Zonation Map of China (GB18306-2001), this area has the seismic peak ground acceleration of 0.10g. According to Earthquake Intensity Zoning Map of China (1990), this area has VII-grade Earthquake Intensity. No destructive earthquake is recorded. Due to mild landform and low precipitation, no mud-rock flow, landslide or other geologic hazards happened.

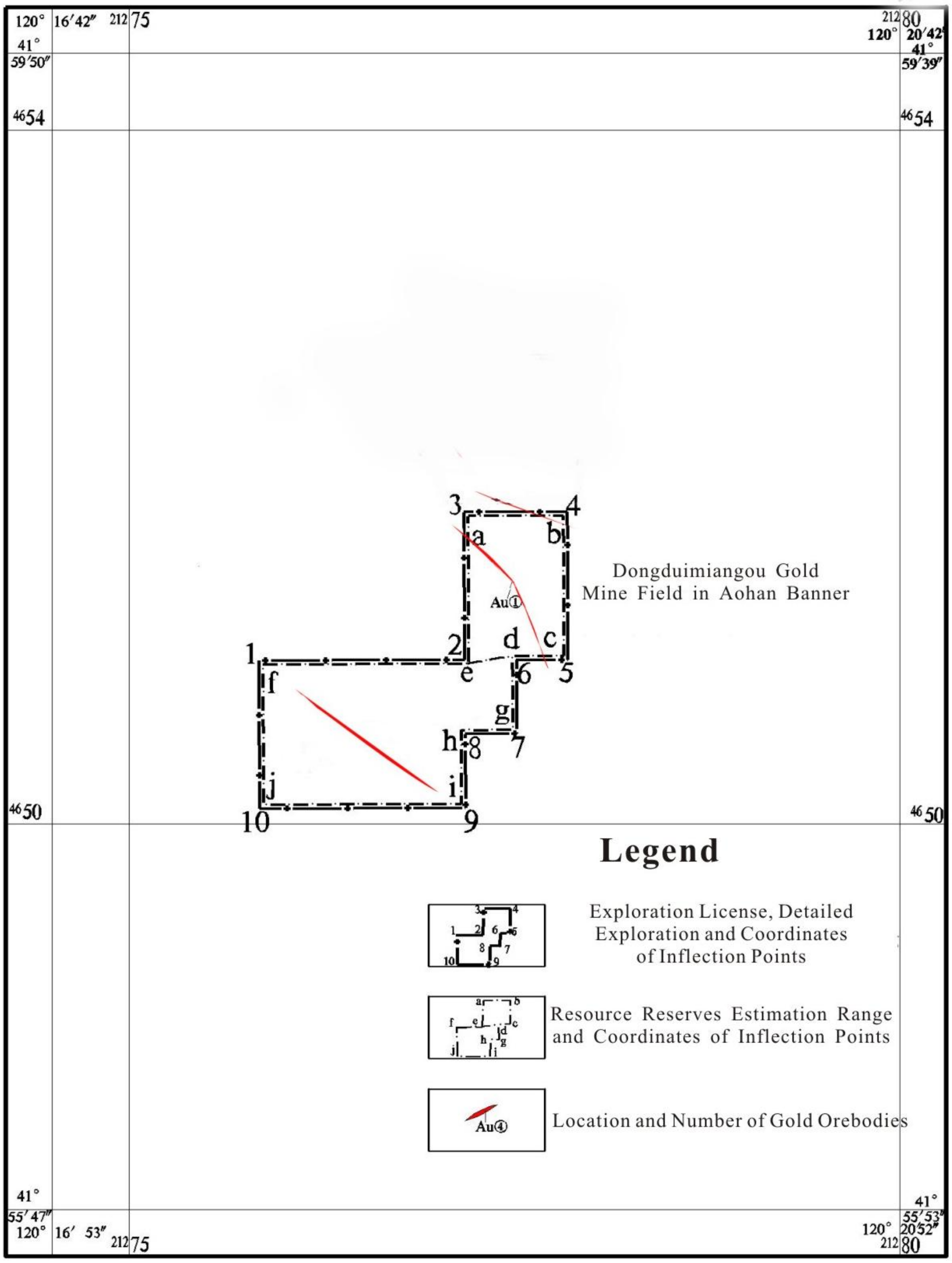
1.1.6 Economic Geography

The mine field is close to residential areas for Mongolian, Han and Hui Nationalities, features mainly the agriculture and seldom animal husbandry and industry, and has several gold mines and ore-dressing plants.

Beipiao-Jinchanggouliang and Xinhui-Jinchanggouliang 66kv transmission lines connected to Northeast China Power Grid pass through the mine field and the coal is from Pingzhuang Coal Mine, so the mine field has convenient energy supply.

The mine field is 3km (4km for haul distance) away from the southeast of Jinchanggouliang Township government, 50km (linear distance) (75km for haul distance) away from Xinhui Township where the government of Aohan Banner lies, and 45km (linear distance) (85km for haul distance) away from Zhaoyang City with railway to the south. They are connected to each other by provincial (municipal) highway (see traffic and location map 1-1).

Exploration License, Detailed Exploration Area and Resource Reserve Estimation Range of Dongduimiangou Gold Mine Field in Aohan Banner, Inner Mongolia Autonomous Region
(Scale: 1:50,000)



1.2 Overview of Previous Geological Work

1.2.1 Previous Regional Geological Work

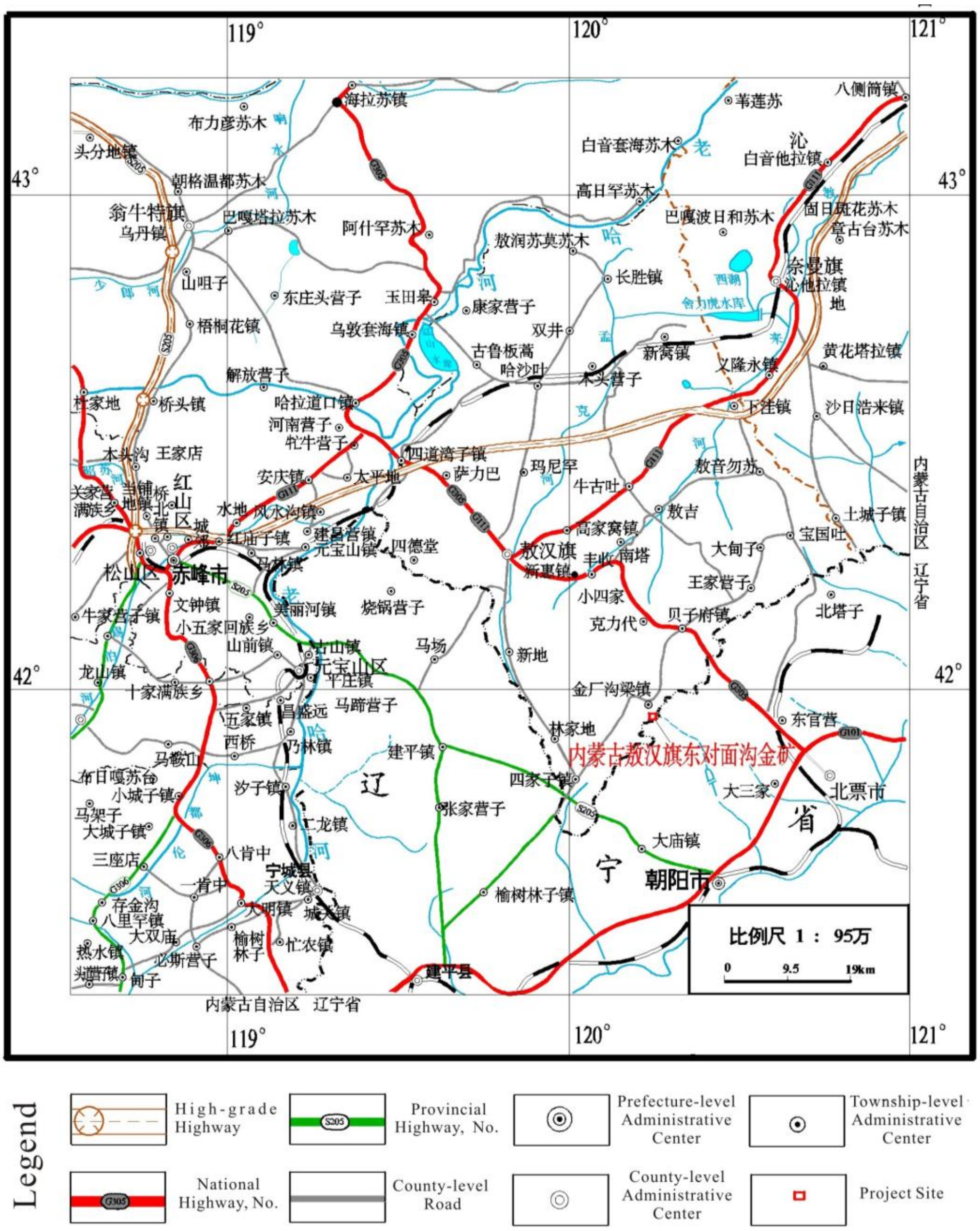
Dongduimiangou Gold Mine Field is an independent mine field in Jinchanggouliang Mine Field, which has a long mining history and has been exploited since Qing Dynasty. In the 1950s, geological work related gold mine was fully conducted Zhao League Geological Brigade of Inner Mongolia Bureau of Geology performed a series of work to find gold ore and determined the further geological work in this area.

In the 1960s, the original 203rd Geological Brigade of Inner Mongolia Bureau of Geology carried out the 1:10,000 geologic mapping to the area of $25Km^2$ in Jinchanggouliang Area.

In 1988 to 1990, the 3rd Geological Brigade of Inner Mongolia Bureau of Geology and Mineral Resources performed the 1:50,000 regional geological survey in Jinchanggouliang-Beizifu Area and carried out general geological work in Dongduimiangou Gold Mine Field.

In 1991, the report on regional geological survey of Jinchanggouliang-Beizifu Area in Inner Mongolia Autonomous Region was submitted and included written report on geological minerals and 1:50,000 geologic map, and the resource reserves of Dongduimiangou Mine Field wasn't submitted. In 1991, the 3rd Geological Brigade of Inner Mongolia Bureau of Geology and Mineral Resources submitted the Geologic Report on General Exploration of Gold Vein 19# of Jinchanggouliang Mine Field and Peripheral Gold Mine in Inner Mongolia Autonomous Region, which involved Dongduimiangou Mine Field, only conducted geological survey, performed no engineering, and didn't present mineral resource reserves (Archive Number: 5846).

Traffic and Location Map



1.2.2 Previous Mineral Geological Work

The owner of mining right, Xinruien Mining Co., Ltd. in Aohan Banner, entrusted Inner Mongolia Tianxin Geological Exploration and Development Co., Ltd. with the general and detailed exploration of Orebodies 1#, 2#, 3# and 4# of Dongduimiangou Gold Mine Field in Aohan Banner (main workload accomplished is listed in table 1-2 and exploration area is 2.07km^2), the later of which discovered 4 gold orebodies and controlled them with the grid spacing of 30m×30m according to the requirements of Type-III exploration.

Washability test conducted by the qualified unit shows that the ore is easy to process. The pre-feasibility study shows that it is economical to develop the mine. Based on the sampling and engineering, the whole mine field has the controlled economic basic ore reserves (112b) of 222,500 tons including 1521.17kg of gold metal and the indicated intrinsic economic ore reserves (333) of 150,700 tons including 892.95kg of gold metal. The mine field has total charge of ore of 373,200 tons, 2414.12kg of gold metal and 5984.49kg of silver metal, and the deposit has the gold grade of 6.47×10^{-6} and silver grade of $16.03\times lO^{-6}$. The occurrence, scale, grade, thickness and other geological characteristics of orebodies have been basically identified, and the orebodies take the form of vein and is of medium-low thermal deposit (including auriferous quartz genetic type).

Table 1-2 Main Material Workload Accomplished in Recent Years

Item	Unit	General Exploration	Detailed Exploration	Supplementary Exploration	Total Workload
1:10,000 Geological Survey	Km^2	2.07			2.07
1:2,000 Geologic Mapping	Km^2	3.35			3.335
Trenching	m3	500			500
Drilling	m			358.30	
Adit	m		2495		2495
Vertical Shaft	m		157		157
Collection and Basic Analysis of Chemical Sample	Piece	131	690	45	866
Sample for Combinatorial Analysis	Piece		3		3
Analysis and Measurement of Sample for Specific Gravity	Piece		56		56
Sample for Internal Inspection	Piece	8	81	15	104
Sample for External Inspection	Piece	18	28	10	56
Sample for Spectroscopic Analysis	Piece	3	19		22
Polished Slice	Piece	1	9		10
Thin Slice	Piece	3	25		28
Sample for Ore-dressing Test	Piece		1		1
Sample for Rock Physical and Mechanical Test	Piece		3		3
Chemical Total Analysis	Piece		3		3
Sample for Phase Analysis	Piece		4		4

1.2.3 Review of Previous Geological Work

During the verification of the Report on Detailed Exploration of Dongduimiangou Gold Mine Field in Aohan Banner, Inner Mongolia Autonomous Region, we basically identify the morphology, occurrence, scale and distribution range of orebodies in the area, basically find out the chemical and physical properties and processing performance of the ore, estimate the reserves appropriately, attain provide reliable retained reserves and provide the resource basis of mine development.

This verification report is based on the Report on Detailed Exploration of Dongduimiangou Gold Mine Field in Aohan Banner, Inner Mongolia Autonomous Region. Most of data on regional geology are referred in this verification report.

1.3 Overview of Mine Design, Development and Resource Utilization

1.3.1 Overview of the Company

This mining area commenced in 2006 and can produce 30,000 tons of ore annually. After it was put into production, the mine has relatively good benefit, is built with 1 vertical shaft, 2 inclined shafts and 3 adits, and can produce 30,000 tons of ore annually. The ore is sent to Duimiangou Ore-dressing Plant and the mining area has self-contained electromechanical facilities, mining equipments and assaying (testing) equipments. At present, the mine field has 69 workers and staff, including 7 administrative and logistical personnel, 3 engineering technical personnel and 59 operating personnel.

1.3.2 Mining Method and Pithead Construction

Underground mining method is adopted and main vertical shaft, inclined shaft + adits are used for the development. The productive capacity of the mine is 100t/d (30,000t/a).

The coordinates of main vertical shafts and inclined shafts currently used are listed in table 1-3.

Table 1-3 Coordinates of Main Vertical Shaft, Inclined Shafts and Main Adits

Orebody No.	Item	X	Y	Z
1	Main Vertical Shaft SJ1 at Duimiangou	4648327.19	40526004.59	705.59
	Main Inclined Shaft XJ2 at Duimiangou	4648028.79	40525970.21	679.29
	Adit 1# (MPD1) at Machegou	4647237.19	40526563.91	678.86
	Adit 2# (PD2) at Duimiangou	4648011.39	40525972.19	679.72
	Inclined Shaft 3# (XJ3) at Duimiangou	4647947.16	40526209.69	705.02

Resuing stoping method is used and the mine has the productive capacity of 100t/d, loss rate of 8%, dilution rate of 10%, gold grade of 5.38g/t and mining capacity of 100t/d. After it is put into production, the mine can produce 30,000 tons of ore annually and 46880 tons of ore in total is mined. It has the recovery rate of 92%, loss rate of 8% and dilution rate of 10%.

1.3.3 Composite Production Cost

The product is gold ore, and the mine has the composite production cost of 5,500,000RMB/a, annual sales revenue of 17,000,000RMB/a and annual profit of 11,500,000RMB and pays 2,800,000RMB/a of tax.

1.3.4 Background of Abandoned Workings

1. Water Yield

According to this verification, Middle Sections I (elevation of 636m), II (elevation of 596m) and III (elevation of 556m) of Vertical Shaft 1#, pithead (elevation of 679m) and bottom (elevation of 607m) of Inclined Shaft 2# with vertical height of 72m, and pithead (elevation of 706m) and bottom (elevation of 553m) of Inclined Shaft 3# with vertical height of 153m in Orebody 1# are being developed. The observation shows that in Vertical Shaft 1#, Middle Sections with the elevation of 636m and 596m basically yield no water and the water gushes from Middle Section with the elevation of 556m. The data reflected the water yield of Middle Section with the elevation of 636m is 6.91m^3/d. In recent years, with the development of deep part of adjacent Jintao Mine, the water yield of this mine field gradually decreases.

2. Roof and Floor of Orebody

Resuing stoping method is adopted, and the abandoned workings have been treated and filled in time, which facilitates geopressure management. The observation shows that the wallrock in the roof and floor is of biotite plagiogneiss, hornblende plagiogneiss and amphibolite and is relatively stable.

1.4 This Work

1.4.1 Schedule of Resource Reserves Verification

Entrusted by Xinruien Mining Co., Ltd. in Aohan Banner, Inner Mongolia, our company performed the field work in the middle ten days of October 2009. At the first stage, September 20 to 28, 2009, leaded by President Xing, our company sampled and investigated the field outcrops and trenches. At the second stage, October 13 to November 12, the geologists and survey crews performed the detailed field and trench investigation and topographic survey, collected the samples for analysis and tests, and then entered the stage of office analysis and report compilation. The closing date of resource and reserve verification is the end of December, 2009.

1.4.2 Principle of Reserves Verification

During this resource reserves verification report, we fully collected the data, exchanged the opinions on related problems with mine management personnel on the basis of analysis and research. The data are mainly provided by the mine. At the initial stage, previous achievement should be fully collected and researched. The actual data derived from mine development should be analyzed and field investigation should be performed on the basis of fully understanding the data.

As for the controlled orebody being developed, the Report on Detailed Exploration of Dongduimiangou Gold Mine in Aohan Banner, Inner Mongolia Autonomous Region is verified and the data on regional geology in this report are used for this verification.

As for newly-found orebodies, light-duty proving holes and exploratory trenches are used for discovery and verification, and the predicted resource reserves of orebodies are primarily estimated.

1.4.3 Working Method and Workload Accomplished

According to the Specifications for Hard-rock Gold Exploration (DZ/T0205-2002) as well as the regulations and requirements related to mineral resource reserves verification, the reserves is verified.

During this verification, we finished 5km^2 of geological revision survey (1:2,000), investigated 26 mineralized bodies (over 6300m of strike length in total), performed 4140m of geological logging, took 55 pictures, constructed 2 boreholes, collected and tested 455 samples, and measured 4560.233m of trenches and 53 surface works.

The workload accomplished is listed in table 1-4.

Table 1-4 Main Workload Accomplished

No.	Item	Unit	Quantity
1	1:2,000 Topographic and Geologic Map (Revision Survey)	km^2	5
2	1:1,000 Exploratory Profile Survey	m	1140
3	Total Strike Length of Mineralized Bodies (7) Investigated	m	6300
4	Geological Logging	m	4140
5	Drilling (2 Boreholes)	m	900
6	Exploratory Trench	m^3	500
7	Sampling and Assaying (Gold and Silver)	Piece	455
8	Pictures	Piece	55
9	Trench Survey	m	4560.2

1.4.4 Work Product

Through this resource reserves verification, the strata, structure, magma and metallogenic geological condition of controlled orebodies being developed are basically identified. The morphology, scale, occurrence and variation in grade of undeveloped orebodies are verified, and the texture, structure, composition and processing performance of ore are basically identified.

1. Retained Resource Reserves Estimation of Controlled Orebodies Being Developed (Mainly Orebody 1#):

1) Retained Resource Reserves:

(122b+333+334) gold ore reserves of 1,857,005t, gold metal of 17,342.3kg and Au average grade of 9.34g/t

Where,

122b Category: Gold ore reserves of 337,838t, gold metal of 2,194.1kg and Au average grade of 6.5g/t. It accounts for 18.2% of total resource reserves.

333 Category: Gold ore reserves of 765,039t, gold metal of 7,825.8kg and Au average grade of 10.23g/t. It accounts for 41.2% of total resource reserves.

334 Category: Gold ore reserves of 754,128t, gold metal of 7,322.3kg and Au average grade of 9.71g/t. It accounts for 40.6% of total resource reserves.

2) Accumulative Utilized Ore Resource Reserves (Mainly Orebody 1#):

46880t, gold metal of 412kg and Au grade of 8.79 g/t

3) Accumulative Measured Resource Reserves:

(122b+333+334) ore reserves of 1,903,885t, gold metal of 17,754.3kg and Au average grade of 9.33g/t

Where,

① Controlled Economic Basic Ore Reserves (122b) of 355,838t, Au metal of 2311.1kg and Au grade of 6.5g/t

② Indicated Intrinsic Economic Ore Reserves (333) of 793,919t, Au metal of 8,120.8kg and Au grade of 10.23g/t

③ Inferred Intrinsic Economic Ore Reserves (334) of 754,128t, Au metal of 7,322.4kg and Au grade of 9.71g/t

2. Newly-found Orebodies

Orebodies 1#-1, 1#-2, 1#-3, 3#, 4#, 5#, 6#, 7#, 8#, 9#, 10#, 11#, 12#, 13#, 14#, 15#, 16#, 17#, 18#, 19#, 20#, 21#, 22#, 23#, 24#, 25# and 26# are all newly-found orebodies, and the exploration is performed to Orebodies 1#-1, 1#-2, 1#-3, 3# and 4#.

3. Basic Work Accomplished

Trench survey, pithead survey and measurement of 4 profiles have been accomplished. The pit and 4140m of exploratory trenches are logged. 455 samples are collected, tested and analyzed. 2 boreholes are constructed. The orebodies are delineated based on the above workload.

2 Geology of Mine Field

The mine field lies in Nuluerhu Uplift Zone of gold and multi-metal metallogenetic belt at the north edge of North China Platform and two approximately symmetric gold metallogenetic subzones are distributed on the both sides of uplift zone.

2.1 Overview of Regional Geology

2.1.1 Stratigraphy

Paleozoic strata in this area belong to Daqingshan Stratigraphic Subzone of Yinshan Stratigraphic Subregion of Jinjiluyu Stratigraphic Region of North China Stratigraphic Province, while Mesozoic strata belong to Ningcheng-Aohan Stratigraphic Subzone of Daxing'anling-Yanshan Stratigraphic Subregion of Circum-Pacific Stratigraphic Region. The strata which crop out in this area include various metamorphic rock of Xiaotazigou Formation of Jianping Group of Archaean Erathem and secondarily continental facies volcanic rock of upper series of Jurassic System of Mesozoic Erathem which unconformably overlies metamorphic rock and wide-spread Quaternary overburden.

1) Xiaotazigou Formation of Jianping Group of Archaean Erathem ($Arjnx^1$)

The lithology of rock which crops out in this area mainly includes migmatized plagioclase hornblende gneiss, and secondarily migmatized hornblende biotite plagiogneiss, migmatized biotite plagiogneiss, migmatized hornblende plagiogneiss, plagioclase hornblende gneiss, plagioclase hornblende, migmatite, hornblende plagioclase granulitite and more. The strata are distributed in east Jinchanggouliang in the northwest of this area, west mining area, Dongduimiangou and Xiaodonggou, take the form of monocline, have the strike of NW, dip of NE and obliquity of 70~89° and obliquely cross ore veins, and the occurrence of gneiss is stable. At some places, granite veinlets penetrate along the gneissosities, take the form of injection stripe and band, form the migmatized gneiss with various structural forms and have the outcrop thickness of 1267m.

2) Mankegouebo Formation of Upper Jurassic Series of Mesozoic Erathem (j_3m^1)

The formation has the main lithology of rhyolitic breccia lava, breccia lava, welded breccia, volcanic breccia and partially intermediate-acidic tuff with thin-bedded tuffaceous sandshale. Its upper part is of rhyolite and rhyolite porphyry with andesite. It is over 400m thick and is located in Nan'gou, Dongduimiangou, Dazhangzi, Jizhangzi, Wulashan and more.

3) Quaternary System (Q)

It is widespread in river beds, river valleys and terraces. Except for relatively high ridges and peaks, this area is almost covered with Quaternary System, which is 10 to 50 meters thick.

2.1.1 Structure

General structures in this area are foundation block fault controlled by discordogenic fault as well as overlying folds and faults.

1) Foundation Folding

Folded structures are mainly developed in Archaean metamorphic rock. Nuluerhu Uplift Zone generally belongs to an anticlise, whose two wings respectively form a series of low-order folds, have the fold axial trend of 60°~70° and extends for several kilometers.

2) Faulted Structure

Faulted structure is a basic structural form of this area. From the aspect of formation time of structure, before Paleozoic Erathem, the crustal block is relatively stable. Most of faults were formed after Neopaleozoic Period, were especially intense during Yanshanian tectogenetic movement, not only control the formation of tectonic basin, but also were rock- and ore-controlling structures of volcanic magma and intruding magma.

The faults at different stages have different directivities. Neopaleozoic faults are mainly EW- and NE-trending, while Mesozoic faults are mainly NNE-trending. There are also some NW-trending faults.

(1) EW-trending Fault (F1)

It mainly features Xiaodonggou-Yizhengbeigou Fault, which is totally 7.6km long. Its west section crops out at Xiaodonggou in the south of Jinchanggouliang Mine Field, passes through the north side of Dongduimiangou, forms the south boundary of Jinchanggouliang Mine Field and north boundary of Dongduimiangou Mine Field, and is intruded by the orthophyre and quartz porphyry along structural belt. Porphyritic medium-fine-grained granite at Duimiangou and gneissic structure of gneissic granite on the north side are also the result of intense extrusion of this structural belt, indicating that this fault is one EW-trending faulted structural zone which is active for a long time.

(2) NEE-trending Fault

NEE-trending Fault is the most developed fault which greatly influences the rock-forming and ore-forming. Xiduimiangou Fault (F2) lies in Yanshanian Intrusive Body in the south part of this mine field, is adjacent to Erdaogou Faulted Basin to the east and uplift foundation of Jinchanggouliang Mine Field, and has the strike of N75°E, dip of NNW and obliquity of 65°. It crosses this mine field in the direction of NEE-SWW, and is totally 5km long and several to tens of meters wide.

(3) NW-trending Fault

Dongduimiangou Fault: This fault is not only ore-conducting structure but also ore-hosting structure, and has the strike length of 500~700m, width of tens of centimeters to several meters and depth extent of over 157m. Fracture plane takes the form of mild sinuosity along the strike and dip and there is tectonic breccia at partial sections. The fault has the strike of N320°W, dip of SW and obliquity of 70°~90°.

(4) Near-SN-trending Fault (F4 and F5)

There are only few near-SN-trending faults, which are only discovered in the north of mine field. Fault F4 has the strike of N15°E, while Fault F5 is N322°W-trending. They belong to secondary ore-hosting fissures or fault controlling ore vein. The faults take the form of steep sinuosity and have small depth extent.

(5) NE-trending Fault

NE-trending faults are a group of the youngest faults, generally cut ore deposit or ore vein, and belong to destructive faults after the metallogenesis.

①Toudaogou Fault (F3): It is a large and important fault in this area, obliquely crosses Jinchanggouliang Mine Field, cuts all strata and rock in the mine field, and divides Jinchanggouliang Mine Field into east and west mining areas. The fault is about 5km long, has the strike of N30°~40°E, dip of NW and obliquity of 65°~85°, gets straight and flat fractured surface, and belongs to normal fault whose NW panel descends and SE panel uplifts. According to geomagnetic field continuation, this fault has small depth extent. Structure-geochemical exploration research shows that the Au and related Ag, Cu, Pb, Zn and other indicator elements in this fault all obviously show low values, indicating that no metallotect is formed after this structure was formed.

② Fangshen-Jinchanggou Hidden Fault: 1:50,000 aeromagnetic profile in plan shows the boundaries of magnetic field with different features. This fault shows no obvious sign at the earth's surface, takes the form of steep gully - Jinchang Gulley - in terms of landform, and has the strike of 295°~320°. This fault is buried 2~5km below the earth's surface and is predicted to be important rock- and ore-conducting structure.

2.1.3 Magma

Magmatic intrusion in this area is frequent and intense. The magma is widespread, crops out in 1/3 of total area, and forms a conspicuous NE-trending structural intruding magma zone which is tens of kilometers long and is distributed along the axial region of Nuluerhu Anticlise as well as several sparse rock masses along other faults. Yanshanian magmatic activities are widespread and intense and produce far-flung small stocks. The rock is mainly of acidic granite and secondarily diorite and granodiorite. In terms of metallogenesis, Yanshanian intrusion has close relationship with the gold, especially the intrusion of late Yanshanian Period. Some rock masses can serve as direct or regenerated source of gold ore.

Only porphyritic medium-fine-grained granite ($\pi\gamma5_3^3$) and porphyritic granodiorite ($\pi\gamma\delta5_3^4$) in Duimiangou Vein of late Yanshanian Period and various ore veins are discovered in this area.

2.1.4 Minerals

The mine field lies in Nuluerhu Uplift Zone of gold and multi-metal metallogenetic belt at the north edge of North China Platform and two approximately symmetric gold metallogenetic subzones are distributed on the both sides of uplift zone.

1) Jinchanggouliang-Beizifu Subzone: It lies on the northwest side of uplift zone and is about 40km long. There are over 20 gold deposits and ore points, which take the form of knob and are mainly distributed in 2 goldfields.

(1) Jinchanggouliang Goldfield: It is distributed in 30Km^2 of area centered on Duimiangou Rock Mass. The rock mass is adjacent to Jinchanggouliang Large-scaled Gold Mine to the northwest, Erdaogou Medium-scaled Gold Deposit (Zhaoyang City of Liaoning Province) in Mesozoic volcanic rock to the southeast, and Changgaogou Small-scaled Gold Deposit in Yanshanian Granite to the south.

(2) Beizifu-Daheishan Goldfield: The ore points are distributed in ligulate ledge of monzonitic granite rock mass near the boundary between Inner Mongolia Autonomous Region and Liaoning Province, are related to Archaean gneiss and intrusive rock, have good prospect, and should be attached much importance to in the future.

2) Shajingou-Sijiazi Subzone: Sijiazi (Inner Mongolia) to Dongwujia (Liaoning Province) to Shajingou Subzone is 75km long, has over 20 medium- and small-scaled gold deposits and ore points in Shajingou, Miliyingzi, Dongwujia, Hanjiadian, Lujiadi and Kangjiawan, merges with north ore belt to, and extends for 100km.

2.2 Geology of Mine Field

2.2.1 Stratigraphy

The exploration area is 2.07km^2 and has relatively simple geology, and the strata which crop out include Xiaotazigou Formation of Jianping Group of Archaean Erathem (Arjnx), Manketouebo Formation of Upper Series of Jurassic System of Mesozoic Erathem (J_3m) and loose sediment of Quaternary System of Cenozoic Erathem

1) Xiaotazigou Formation of Jianping Group of Archaean Erathem (Arjnx)

The strata are a set of mesometamorphic rock formations, spread in the direction of NW, dip to NE and have the obliquity of 75°~88°. Its main lithology includes migmatized plagioclase hornblende gneiss, plagioclase hornblende gneiss, migmatized hornblende biotite plagiogneiss, plagioclase hornblende, hornblende and little leucogranulitite. The strata in this area take the form of monocline, have the strike of 290°~300°, dip of NE and obliquity of 72~80°, sometimes show the sign of inversion and obliquely cross ore veins, and the occurrence of gneiss is stable. At some places, granite veinlets penetrate along the gneissosities, take the form of injection stripe and band, and form the migmatized gneiss with various structural forms. The strata are 767m thick.

Lithological Features:

(1) Migmatized Plagioclase Hornblende Gneiss: It is gray and grayish green and has the blastogranular texture as well as gneissic and banded structure. The content of main minerals is: 45%~50% for hornblende, 35%~45% for plagioclase, 20% for quartz and 15% for orthoclase. Secondary minerals include the chlorite, sericite and epidote, and accessory minerals include the apatite, monazite and magnetite.

(2) Migmatized Hornblende Biotite Plagiogneiss: It is light gray and grayish green and has the blastogranular and palimpsest texture as well as gneissic and banded structure. The content of main minerals is 50%~60% for plagioclase, 10%~15% for biotite, 10% for hornblende, 5% for quartz and 3% for microcline. Secondary minerals include the epidote and sericite. Accessory minerals include the apatite, zircon and sphene.

(3) Plagioclase Hornblende Gneiss: It is grayish green and light gray and has the blastogranular texture as well as gneissic and streaky structure. The content of main minerals is 40%~50% for hornblende, 20%~30% for plagioclase, 5% for quartz and 3%~5% for microcline. Secondary minerals include the sericite, chlorite, carbonate and epidote. Accessory minerals include the pyrite and apatite.

(4) Plagioclase Hornblende: It is light grayish green and green and has blastogranular and blastophitic texture as well as gneissic and banded structure. The content of main minerals is 75%~80% for hornblende, 10%~15% for plagioclase and 10% for biotite. Secondary minerals include the sericite, chlorite, epidote, carbonate and uralite. Accessory minerals include the apatite and pyrite.

This formation is an important ore-bearing horizon of gold deposits in this area. The north and east sides of the strata are surrounded and covered by Mesozoic volcanic rock, and the south side has intrusive contact relationship with porphyritic medium-fine-grained granite and crops out in an area of 0.026km^2.

Micro-gold test performed by the 3rd Geological Brigade of Inner Mongolia Bureau of Geology and Mineral Resources in the 1980s shows that the average gold abundance is 12.1ppb. According to the test result of samples from this formation in the adjacent area in 1990, the isochron age of zircon is 2.54 billion years. The 3rd Geological Brigade of Inner Mongolia Bureau of Geology and Mineral Resources recovered the native rock through analytical data of 34 different metamorphic rock samples and the native rock is mainly composed of intermediate-basic volcanic rock and little ultrabasic and intermediate-acidic volcanic rock.

2) Manketouebo Formation of Upper Series of Jurassic System of Mesozoic Erathem (J_3m)

Main body lies in the northeast of mine field in the direction of NW and only the lower part crops out in this area. The lithology is mainly rhyolitic breccia lava, little breccia lava and volcanic breccia, and partially intermediate-acidic tuff with thin-bedded tuffaceous sandstone. The outcrop thickness is 76m.

3) Quaternary System of Cenozoic Erathem

The strata are widespread in river beds, river valleys and terraces and are developed in the west of mine field. The sediments mainly include gritstone bed eroded by stream flow, diluvium, loess and clay bed, and is generally 10~40m (50m for the maximum) thick.

2.2.2 Structures

This mine field lies in Nuluerhu Palaeostructureal Uplift Zone, so it is in relatively stable state for a long time after the foundation was formed. Tectogenetic movement has become intenser and intenser since Neopaleozoic Period, especially Yanshan Movement of Mesozoic Period. Therefore, the current tectonic framework which mainly features Mesozoic tectonic basins, tectonic domes and complex faults are formed.

1) Basement Tectonics

The basement of Dongduimiangou Mine Field is of monoclinal structure formed by Archaean gneiss and small tight folds can be found at some places. Rock jointing and fissures are developed. The gneissosity has the strike of NW, general dip of NE and obliquity of 75°~88°.

2) Duimiangou Intrusive Dome Structure

The superposition and intrusion of Duimiangou complex rock mass in late Yanshanian Period resulted in the uplift of block mass, and then formed this structure. Generally, it is composed of a series of radial cracks of center rock mass and surrounding rock mass and ring dykes. Ring dykes are distributed in the place 0.5~1km around rock mass and are composed of interruptedly-distributed orthophyre, quartz porphyry and biotite trachyandesite. Radial cracks are located in the place 0~3km around rock mass and control the distribution of various dykes and ore veins.

3) Faulted Structure

The faults are a main structural form of this area, are mostly younger than Yanshanian Period, and are sequenced as follows by time: EW-trending ~ SN-trending ~ NW-trending ~ NE-trending. The first 3 groups are of pre-metallogenic or metallogenic structures, while the last group is of post-metallogenic structure. There are the following several faults in the mine field:

(1) NEE-trending Fault: NEE-trending Fault is the most developed fault which greatly influences the rock-forming and ore-forming. Xiduimiangou Fault (F2) lies in Yanshanian Intrusive Body in the south part of this mine field, is adjacent to Erdaogou Faulted Basin to the east and uplift foundation of Jinchanggouliang Mine Field, and has the strike of N75°E, dip of NNW and obliquity of 65°. It crosses this mine field in the direction of NEE-SWW, and is totally 5km long and several to tens of meters wide. This fault is a fracture zone, and rock fragmentation, fault gouge, tectonic breccia, compression schistosity and lens can be found in this zone. Ore Veins 2#, 3# and 4# in the mine field are all formed in this fracture zone. It is a very important ore-controlling fracture zone which shows the sign of gold enrichment at some places and is accompanied by sliver ore.

(2) NW-trending Fault (F6): It refers to Dongduimiangou Fault and mainly features Ore Vein 1# at Dongduimiangou. This fault is not only ore-conducting structure but also ore-hosting structure, and has the strike length of 500~700m, width of tens of centimeters to several meters and depth extent of over 157m. Fracture plane takes the form of mild sinuosity along the strike and dip and there is tectonic breccia at partial sections. The fault has the strike of N328°W, dip of SW and obliquity of 70°~90°. The rock in the fracture zone is intensely crushed, and the cataclasite, kataclastic rock, mylonite and fault gouge are widespread. Compression schistosity and compression leans are very developed. The lens is composed of wall rock and ore veins are surrounded by wall rock. Some wall rock is the orebody or mineralized body. It has tensional feature. There is tectonic breccia at partial section and ore veins controlled by the fault mainly takes the form of nervation. Mineralization type is of auriferous quartz type. The pyrite and quartz in the fracture zone form clear banded structure at some places, have the identical extension direction with the fault, or cross it with a small angle. Intense rock fragmentation provides the space for metallogenesis. Orebody 1# in this mine field is formed in this fracture zone and is controlled by its morphology.

(3) Near-SN-trending Fault (F4): It lies in the middle-south of mine field, is 660m long and 1m wide, and the strike of N15°E. This fault passes through porphyritic granodiorite, porphyritic mediun-fine-grained granite, metamorphic strata of Xiaotazigou Formation, biotite trachyandesite vein and quartz vein from south to north, is the youngest fault in the mine field, crosses no orebody, and doesn’t destruct the orebodies.

(4) Other Faults: A large number of NW-trending faults belong to low-order faults or fissures and have the following several features: ① It is mostly filled with various dykes or ore veins; ② It shows up in a concentrative manner; ③The orientation changes with the location and

varies between 290° and 340°, and the faults have the general dip of NE and obliquity of 70°~80°; ④ It has tenso-shear and tensional features; and ⑤It has tight structure, generally extends for hundreds of meters to over 1000 meters, and changes great in depth extent.

2.2.3 Magmatic Rock

This mine field lies in a relatively stable environment before Mesozoic Period. Intense tectonism resulted in the intense and frequent magmatic activities after Yanshan Movement of Mesozoic Period. Volcanic magma is altered with intruding magma, both of which are widespread and form a very important feature of this mine field.

Various intrusive bodies are widely distributed in the south of mine field.

1) Duimiangou Porphyritic Granite ($\pi\gamma5_3^3$)

It lies on the south side of Dongduimiangou, spreads in the direction of EW, is about 4km long, is of porphyritic medium-fine-grained granite, and has the offwhite-light-red medium-fine granular and granite porphyroclastic texture as well as massive structure. The content of main minerals is 50% for plagioclase, microcline and perthite, 20% for quartz, 5%~7% for biotite and about 5% for hornblende. The quartz at some places is lengthened in the fixed direction, which is identical with latitudinal tectonic belt controlling this rock mass. The rock mass contains some medium-grained granite and plagiogranite and has gradual change relationship with porphyritic medium-fine-grained granite. This rock mass belongs to intrusive body of the second stage of later Yanshanian Period and has no genetic relationship with ore deposit.

2) Duimiangou Complex Rock Mass ($\pi\gamma\delta5_3^4$)

This rock mass is a complex rock mass formed by homocentric intrusive rock with the same lithology and different structures. The lithofacies of peripheral area is of medium-fine-grained granite with plagioclase and hornblende phenocryst, while that of internal area is of porphyritic granodiorite. Although some porphyritic granodiorite intrudes into medium-fine-grained granite and even the inclusion of the former is found in porphyritic granodiorite, they basically has the gradually transition relationship, indicating that they are intrusive bodies with the same source and different phases.

Lithologic Features: Porphyritic Granodiorite ($\pi\gamma\delta5_3^4$): It is offwhite, light gray and grayish green and has the granite porphyritic texture as well as massive structure. The content of minerals is 30% for plagioclase, 23% for quartz, 26% for potash feldspar, 10% for hornblende, 7% for biotite, and few sericite and chlorite. Accessory minerals include the apatite, magnetite and sphene. Rock mass intrudes mediun-fine-grained porphyritic granite in the shape of ellipse.

This rock mass crops out in the south of Dongduimiangou Mine Field and takes the form of small stocks less than 4km. This rock mass has close spatio-temporal and genetic relationship with the mineralization of gold. Isotopic dating of this rock mass shows that the potash feldspar K~Ar age of medium-fine-grained granite is 126.3Ma, and 125.51Ma for zircon U~Th~Pb age. Porphyritic granodiorite complementarily intruded at late stage has total rock K~Ar age of 121.5Ma and is the result at the last stag of late Yanshanian Period.

3) Various Dike Rock

Beside the above intrusive bodies, there is various dike rock in this area. They have the following features:

(1) Multifarious Petrographic Categories: The granite porphyry, granite aplite, andesitic porphyrite, rhyolite porphyry and biotite trachyandesite are frequently found.

(2) Wide Distribution: The dykes are widespread in various rock and strata in the mine field.

(3) Long Perdurability: They are mainly formed in Yanshanian Period and go through magmatic activities. According to the cut-through relationship, they can be sequenced as follows: andesitic porphyrite ~ rhyolite porphyry, early quartz porphyry ~ late quartz porphyry, and biotite trachyandesite.

(4) Distribution Rule: The dykes are distributed in the identical manner with gold ore veins, are developed around Duimiangou intrusive dome structure, and take the shape of rediatiform or ring.

2.2.4 Wallrock Alteration

Wallrock alteration mainly includes the chloritization, sericitization, pyritization, silification and carbonatation and is the result of low-temperature alteration accompanied with metallogenetic activities.

(1) Chloritization: It is dark-colored minerals in gneiss, is produced by the alteration of hornblende, is generally dark green, and is the most frequently found alteration. It spreads in a large area, is up to several meters wide, and gradually decreases in the intensity from the center of ore vein or mineralized fracture zone to the wallrock on both sides. It is altered the earliest and is one of main gangue minerals in the ore.

(2) Sericitization: It is the result of the sericitization of plagioclase. It often appears together with the chloritization, ranges from fracture zone to wallrock, and gradually decreases in intensity. The section intensely sericitized increases in metallic sulfide and gold grade and consequently becomes an important composition of gold ore vein. Due to hypergenetic weathering, part of sericite changes into the hydromica and kaolin, takes the form of white and off-white pelitomorphic band, and is very conspicuous.

(3) Pyritization: It is produced by the sulfur and iron in hydrothermal rock entering the wallrock. It is widespread, lasts for a long time, goes through various alterations, is generally intense at the place close to ore vein, mainly takes the form of veinlet or fine stockwerke, and transits from dense dissemination to sparse dissemination to asterism or spot. Under the effect of moderate-low-temperature hydrothermal rock, the pyritization in fracture zone often superposes the sericitization, increases gold content and makes it industrial ore.

(4) Silification: It is mainly reflected by the enhancement in the kiesel of wallrock and the filling of stockwerke and veinlet quartz, and is mostly distributed at the place close to gold-bearing quartz vein or inflated section of orebody. The section intensely silicified frequently increases in metallic sulfide and gold content.

(5) Carbonatation: It is the result of alteration at the late stage of hydrothermal ore-forming solution, fills the fissures in the form of veinlet and stockwerke, and doesn't have close relationship with gold mineralization.

Among alteration products accompanied by the above ore-forming process, the chlorite widely infiltrates in the wallrock and is over 2m wide, and the sericite is mostly limited in ore vein and also exists in the schistosities of vein walls and wallrock close to the ore. Under the microscope, potassic alteration minerals have already replaced the hornblende, feldspar and other potassic minerals in native rock.

2.3 Characteristics of Orebody

2.3.1 Spatial Location, Morphology, Scale and Occurrence of Orebodies

There are 26 orebodies in Dongduimiangou Gold Mine Field verified this time, which are numbered Orebodies 1#, 2#, 3#, …, 26#. Among them, only Orebody 1# is the controlled orebody being developed.

The orebodies occur in gneissic fracture zone of Dayingzi Formation. Since Quaternary System is widespread and covers a large area, most of orebodies are the hidden orebodies. The outcrop of gneissic fracture zone shallow buried is disclosed with exploratory trenches, shows the features of alteration and mineralization, and is controlled with the pits in the deep part. Ore vein is used to control the length of orebody and the ort is used to find the thickness and variation in grade of orebody.

Orebody 1#:

It lies in the middle of mine field, takes the shape of vein, and has the strike of 328°, dip of 220°-240° and obliquity of 68°-78°. According to 21 exploratory trenches, Orebody 1# is 1450m long and 0.50~2.00m (0.87m for the average) thick, and has the grade of 1.04~33.6g/t (6.02g/t for the average). The deep part is controlled by 3 sections, namely North, Middle and South Sections. The depth extent, extension, thickness and variation in grade of orebodies in North section are controlled with three 40m-high middle sections and one adit.

PD1 (elevation of 705m): The orebody controlled is 137.5m long and 0.48~1.95m (1.02m for the average) thick, and has the Au grade of 1.95~5.31g/t (3.41g/t for the average).

Middle Section 1# (elevation of 636m): The orebody controlled is 409m long and 0.48~2.00m (1.01m for the average) thick, and has the Au grade of 1.22~27.4g/t (6.64g/t for the average).

Middle Section 2# (elevation of 596m): The orebody controlled is 254m long and 0.48~1.81m (0.98m for the average) thick, and has the Au grade of 1.25~9.28g/t (3.76g/t for the average).

Middle Section 3# (elevation of 556m): The orebody controlled is 209m long and 0.48~2.4m (1.04m for the average) thick, and has the Au grade of 1.59~33.6g/t (6.65g/t for the average).

The depth extent, extension, thickness and variation in grade of orebodies in the deep part of Middle Section are controlled with two 40m-high inclined shafts and two adits.

PD2 (elevation of 681m): The orebody controlled is 300m long and 0.49~1.5m (0.96m for the average) thick, and has the Au grade of 1.4~8.98g/t (5.23g/t for the average).

Inclined Shaft 2# (elevation of 607m): The orebody controlled is 241m long and 0.9~2.00m (1.01m for the average) thick, and has the Au grade of 1.33~10.69g/t (5.01g/t for the average).

PD3 (elevation of 705m): The orebody controlled is 370m long and 0.49~2.00m (1.48m for the average) thick, and has the Au grade of 2.1~16.0g/t (7.58g/t for the average).

Inclined Shaft 3# (elevation of 554m): The orebody controlled is 94m long and 0.49~2.00m (0.79m for the average) thick, and has the Au grade of 5.49~7.71g/t (6.54g/t for the average).

The depth extent, extension, thickness and variation in grade of orebodies in the deep part of South Section are controlled with two 40m-high adits.

MPD1 (elevation of 680m): The orebody controlled is 213m long and 0.49~2.00m (1.48m for the average) thick, and has the Au grade of 2.92~15.6g/t (8.17g/t for the average).

MPD2 (elevation of 708m): The orebody controlled is 30m long and 0.98~2.00m (1.5m for the average) thick, and has the Au grade of 1.33~5.64g/t (4.08g/t for the average).

Orebody 1# has the total true thickness of 0.49~2.00m (1.01m for the average), coefficient of variation in thickness of 1.02, Au grade of 1.22~33.6g/t (6.02g/t for the average) and coefficient of variation in grade of 1.36. The inclined depth of controlled orebody is 249m.

Orebody 2# (Namely Orebodies 2#, 3# and 4# in the Report on Detailed Exploration):

It lies in the middle of mine field, takes the shape of vein, and has the strike of 290°, dip of 20° and obliquity of 80°. The superficial part of Orebody 2# is controlled by 9 exploratory trenches, is 879m long and 0.49~1.18m (0.70m for the average) thick, and has the grade of 1.34~22.58g/t (10.4g/t for the average). The depth extent, extension, thickness and variation in grade of orebodies in the deep part are controlled by vertical shafts (in development) in two 40m-high middle sections and one adit.

During the verification of Orebody 2#, since the vertical shafts are being repaired, surface work and sampling through adit are mainly performed and the 333-category resource reserves above the vertical shaft development system are estimated.

Orebody 3#:

It is lies in the north of mine field, is constructed with 2 vertical shafts, is 0.49~0.78m (0.54m for the average) thick, and has the grade of 1.01~30.19g/t (14.7g/t for the average). Vertical Shaft 1# is developed with 1 middle section and controls 194m orebody along the vein, while Vertical Shaft 2# is built with 1 middle section and controls 40m orebody along the vein.

Orebody 4#:

It is lies in the east of mine field, is disclosed with 1 adit, which controls 200m orebody, has the average grade of 11.9g/t, and is 0.49~1.3m (0.78m for the average) thick. The earth’s surface is controlled by 2 exploratory trenches.

The data on Orebodies 5~26# are listed in table 2-1.

Table 2-1 Summary of Orebodies 5~26#

Orebody No.	Length of Orebody	Thickness of Orebody	Occurrence
5#	330m	0.7m	30°∠70°
6#	253m	0.7m	35°∠70°
7#	85m	0.5m	170°∠73°
8#	82m	0.5m	225°∠70°
9#	430m	0.87m	205°∠68°
10#	100m	0.6m	125°∠70°
11#	250m	1.1m	20°∠70°
12#	660m	1.26m	20°∠70°
13#	60m	0.47m	45°∠69°
14#	60m	0.5m	45°∠69°
15#	170m	0.9m	225°∠70°
16#	90m	0.5m	225°∠70°
17#	110m	0.69m	225°∠69°
18#	80m	0.4m	230°∠67°
19#	85m	0.8m	230°∠65°
20#	130m	1.0m	230°∠70°
21#	250m	0.65m	225°∠72°

22#	230m	0.73m	210°∠76°
23#	45m	0.5m	250°∠69°
24#	45m	0.5m	248°∠70°
25#	300m	0.7m	265°∠74°
26#	60m	0.7m	80°∠75°

2.3.2 Basic Features of Ore

Native Gold:

(1) Granularity

The granularity measurement statistics (table 2-2) of 1901 native gold samples in 12 polished slices show that it mainly features the particulate, secondarily fine grain, measly medium and coarse grain, and occasionally giant grain. Field observation and microscopic examination show that coarse~giant grained gold is mostly distributed in galenite as well as quartz substrate outside the pyrite, chalcopyrite and galenite.

Table 2-2 Statistics of Gold Granularity

Number of Samples: 11	Giant-grained Gold >0.295mm	Coarse-grained Gold 0.295~>0.074mm	Medium-grained Gold 0.074~>0.037mm	Fine-grained Gold 0.037~>0.01mm	Particulate Gold ≤0.01mm	Total
Number of Grain	1	29	309	1184	378	1901
Percentage	0.05	1.53	16.25	62.28	19.88	100

(2) Morphological Characteristics

Native gold has complex morphology, generally takes the form of flakelet, arborization and cumularspharolith, and gets the individual granule of over 1mm. Particulate~fine-grained gold has more complex morphology and takes the shape of nubbin tablet, pigtail, toroid, puncheon, stab, needlepoint, filament, rhizoid, bended or annular hairline, rainworm, drip, bow and taper.

(3) Gold Occurrence

According the analysis of thin slice and polished slice, gold minerals in this deposit mainly include native gold and electrum. They take the form of packed gold, intergranular gold and fissure-filling gold and occur in the ore. The percentage of each type is listed in table 2-3.

Table 2-3 Statistics of Gold Occurrence

Gold Occurrence		Content (%)	
Packed Gold	In pyrite	32.73	78.46

	In chalcopyrite	15.23	
	In gangue	30.50	
Intergranular Gold	Between pyrite and gangue	4.60	10.71
	Between chalcopyrite and magnetite	0.12	
	Between pyrite and chalcopyrite	3.21	
	Between pyrite and gangue	2.78	
Fissure-filling Gold	Between the fissures of pyrite	10.83	10.83

According to the data on polished slice under the microscope, the occurrence of native gold is as follows:

①. It is distributed in micro cracks of various minerals in the form of irregular particulate.

②. It is distributed in the interstice of minerals or between the grains in the form of irregular particulate.

③. It is distributed in pyrite and chalcopyrite particles in the form of irregular fine grain.

④. It is distributed in quartz substrate near various metallic minerals in the form of irregular fine grain and occasionally giant grain.

⑤ Crystal stocks of tablet-shaped native gold and chalcopyrite are distributed in the interstice of pyrite aggregate.

⑥ Crystal stocks of native gold and galenite are distributed in the crushed pyrite particles.

⑦ Native gold is distributed in galenite particles and colloidal pyrite aggregates or along the edge of magnetite particles in the form of particulate, is half packed, and is located around magnetite particles.

(4) Fineness of Gold

Electron microprobe analysis is performed to gold minerals in the ore and the result is listed in table 2-4.

Table 2-4 Electron Microprobe Analysis Result of Native Gold (%)

Sample ID	Occurrence	Au	Ag	Fe	Cu	Bi	Sb	S	As	Te	Total	Fineness
L3	Native Gold in Fine-grained Pyrite	81.28	18.10	0.33	0.14	0.02	0.00	0.00	0.00	0.00	99.87	813
L3	Native Gold in Medium-grained Pyrite	74.81	24.72	0.25	0.07	0.00	0.00	0.00	0.00	0.00	99.85	725
L3-3	Native Gold in	82.13	17.11	0.12	0.06	0.07	0.00	0.00	0.00	0.00	99.49	826

	Chalcopyrite											
	Average Value (3)	79.41	19.98	0.23	0.09	0.03	0.00	0.00	0.00	0.00	99.74	788

From the table, gold minerals in this ore deposit feature mainly native gold and secondarily electrum. The gold associated with chalcopyrite has the highest fineness, while the gold associated with pyrite has low fineness. The fineness of gold varies between 725 and 826 (788 for the average).

Pyrite: It is main gold-bearing minerals in this deposit and accounts for over 78% of metallic minerals. It mainly takes the form of fine-mediun-grained xenomorphic~hipidiomorphic granular aggregate and few colloidal aggregates, and is distributed in quartz vein or various altered rock in the shape of asterion, lump and veinlet. Large pyrite lump is up to 15cm. Single pyrite vein is up to 2m long and 8cm thick.

Monomineral analysis result of pyrite is listed in table 2-5.

Table 2-5 Chemical Analysis Result of Pyrite

Sample ID	Fe (%)	S (%)	Au (ppm)	Ag (ppm)	Cu (ppm)	Pb (ppm)	Zn (ppm)	Co (ppm)
L3-3-6	46.42	52.29	55	12	18	129	0	65
L3-4-3a	46.78	52.32	226	31	21	354	0	27
L3-4-3b	46.80	52.65	350	45	23	378	0	24
L3-6-11	47.48	53.41	852	76	22	275	211	84
Average Value (4)	46.87	52.67	370.8	41	21	284	52.8	50
Common Moderate-low-temperature Hydrothermal Gold Deposit			336	0.6	99.4	70	134	35.9
Sample ID	Ni (ppm)	Se (ppm)	Te (ppm)	As (ppm)	Sb (ppm)	Bi (ppm)	Hg (ppm)	Au/Ag
L3-3-6	223	1.2	17.6	34	0	43	0.2	4.6
L3-4-3a	144	1.0	10.0	21	1	27	0.4	7.3
L3-4-3b	23	1.1	7.2	25	1	23	0.3	7.8
L3-6-11	146	0.1	6.6	31	0	87	1.9	11.2
Average Value (4)	134	0.9	10.4	27.8	0.5	45	0.7	7.7
Common Moderate-low-temperature Hydrothermal Gold Deposit	34.1	50		7670	114			

According to field observation and microscopic examination data, the pyrite is formed at each metallogenetic stage, especially late Yanshanian period. It can be divided into 3 stages by formation time of minerals and interrelation. The pyrite of different stages has great difference in crystal form, granularity, color and crystal characteristics.

(1) 1st Metallogenetic Stage of Later Yanshan Period

The pyrite formed at this stage is mostly grayish yellow and medium-coarse grained, is well crystallized, is distributed disseminatedly in the form of single crystal or aggregate, is mostly replaced by later metallic minerals, and doesn't has close relationship with native gold, and few replacement remnants can be found.

(2) 2^{nd} Metallogenetic Stage of Later Yanshan Period

The pyrite formed at this stage is light yellow white and light yellow and medium-fine-grained, has low degree of idiomorphism, takes the form of xenomorphic~hipidiomorphic grain, is in the shape of lump or vein, gets cataclastic texture, often replaces early pyrite, is then replaced by magnetite, and is closely related to native gold.

(3) 3^{rd} Metallogenetic Stage of Later Yanshan Period

The pyrite formed at this stage can be divided into 2 seculas. The early pyrite is light yellow, takes the form of xenomorphic~hipidiomorphic grain, and is often associated with the chalcopyrite, galenite and tetrahedrite. The later pyrite is light grayish yellow, takes the form of colloidal aggregate and is mostly formed by replacing early pyrite. The pyrite formed in later Yanshanian Period has close relationship with gold mineralization and late Yanshanian Period is one of main metallogenetic periods.

Chalcopyrite: It is one of important gold-bearing minerals in this deposit, accounts for 0.3~2.09% of metallic minerals, takes the form of particulate~fine-grained hipidiomorphic grain, and is often associated with galenite, blende and tetrahedrite to form multi-metal mineralized ore. It is mostly in the shape of veinlet, stockwerke and irregular lump, is distributed in quartz vein or cracks of pyrite, or is replaced by later pyrite.

2.3.3 Texture and Structure of Ore

(1) Ore Texture

Ore Texture: It mainly includes xenomorphic granular texture, hipidiomorphic granular texture, mosaic texture, cataclastic texture, inclusion metasomatic texture and more.

1. Xenomorphic Granular Texture: The pyrite, galenite, chalcopyrite and other metallic minerals in the ore take the form of xenomorphic grain, inlay each other, and have unclear boundary and broken crystal morphology. No intact crystal is found.

2. Hipidiomorphic Granular Texture: The pyrite takes the form of angular and hipidiomorphic grain, and the galenite is in the form of irregular cuboid particle.

3. Mosaic Texture: The galenite and chalcopyrite, chalcopyrite and pyrite, and pyrite and pyrrhotite hipidiomorphic crystals respectively inlay each other, and show the sign of crystal stock.

4. Cataclastic Texture: Since the metallogenesis is the result of long-term tectonic activities, it is often in irregular form due to tectonic stress and nature gold fills the crack of pyrite.

5. Corrosion Texture: The tetrahedrite, pyrite, blende and galenite corrode along the fissure of pyrite and edge of particle.

6. Inclusion Metasomatic Texture: Coarse-grained pyrite is packed and replaced by the chalcopyrite, galenite and blende.

7. Poikilitic Texture: Granular native gold is included in the pyrite, blende and quartz. The pyrite, quartz and tetrahedrite envelop native silver, which envelops native gold.

(2) Ore Structure

Ore structure is complex and includes mainly massive structure and disseminated structure, and secondarily banded, stockwerke and brecciated structures.

1. Massive Structure: The pyrite, galenite, chalcopyrite and other multi-metal sulfides in the ore compactly inlay each other in the form of granular aggregate, are of xenomorphic crystals, have small granularity, and are distributed randomly.

2. Disseminated Structure: The pyrite and other metallic sulfides in the ore are disseminatedly distributed in quartz vein, take the form of irregular conglomeration, stockwerke and xenomorphic crystal, and have small granularity.

3. Pelitomorphic Structure: After ore vein is formed, pelitomorphic altered rock is formed on both sides.

4. Banded Structure: Metallic sulfides are distributed in quartz vein in the shape of band and show the characteristics of contemporaneous formation with quartz vein.

5. Stockwerke Structure: At late stage, the pyrite and other metallic sulfides take the shape of stockwerke and fill the cleavage and fissures in quartz vein.

6. Brecciated Structure: After part of orebodies or minerals were formed, tectonic activities occurred again and crushed the orebodies or minerals or the ore formed at early stage, which were cemented together by later hydrothermal rock. The ore or metallic sulfides formed at early stage is re-cemented in the form of breccia. This kind of structure is rare.

2.3.4 Mineral Sequence

The faults formed by different stress fields are prevalent in mine field, and the alteration and mineralization formed at different metallogenetic stages superpose and represent 3 metallogenetic stages (phases).

1. Single body of pyritic quartz vein partially shows the sign of pinch reproduction, ramification recombination and rapidly intumesced or shrunk irregular shape. Wallrock breccia is frequently found in quartz vein, takes the shape of cusped edge, has great difference in granularity, is distributed randomly, and gets clear boundary. Native gold particulates are occasionally packed in the pyrite.

The above phenomenon indicates that the formation of pyritic quartz vein is controlled by tensional fracture zone and it is the first metallogenetic stage.

2. Pyritic quartz vein is compressed to form dense fissures parallel to quartz vein and sparse bended fissures vertical to quartz vein, and the fissures are filled with the pyrite or chlorite and sericite and cut through syngenetic pyrite in quartz vein. Microscope observation shows that the

quartz features undulant or uneven extinction and polished section analysis shows that fine-grained~particulate native gold is often found in hidden crack of pyrite or between pyrite particles.

It indicates that after pyritic quartz vein was formed, the vein went through crushing stress and was accompanied with gold mineralization, and it is the second metallogenetic stage.

3. Intensely crushed section of pyritic quartz vein also has pelitomorphic crushed altered rock formed by intense sericitation, chloritization and mineralization, which change the quartz or pyrite developed with fissures into the breccia, and caesious quartz or magnetite associated with pyrite, chalcopyrite, galenite and tetrahedrite cement them into tectonic breccia altered rock. Polished section analysis shows that particulate~fine-grained native gold is often attached to the magnetite, pyrite, chalcopyrite, galenite and tetrahedrite, or fills the gap between the above mineral particles.

It indicates that after pyritic quartz vein formed at early stage was compressed and was accompanied with gold mineralization, another tectonic activity was also accompanied by gold metallogenesis, and it is the third metallogenetic stage.

4. The pyrite formed at early stage is often replaced by colloid pyrite into relic grain or relic band, and particulate native gold is also found in colloid pyrite.

It indicates that at the stage of pyritic sulfide quartz, the formation of gold can be divided into multiple seculas.

5. The carbonate in the shape of vein is prevalent in the orebody and goes through all the above phenomenon. It indicates that the last metallogenesis in this area ended with the carbonatization.

According to the analysis of the data on other orebodies in Jinchanggouliang Mine Field, gold metallogenetic phases are summarized as follows:

1) 1st Hydrothermal Metallogenetic Phase of Late Yanshanian Period

This metallogenetic phase can be divided into 2 metallogenetic stages: at the first stage, under the effect of SN crushing stress field, it was accompanied by the pyrite-quartz stage, and the sericitization, chloritization and carbonatization happened. Some gold was formed and can't make up industrial orebody due to small amount. At the second stage, under the effect of near-WE crushing stress field, it is accompanied with the gold, metallic sulfide, chlorite and sericite~quartz stages, and is one of main metallogenetic stage in this area.

2) 2nd Hydrothermal Metallogenetic Phase of Late Yanshanian Period

This phase has only 1 metallogenetic stage, namely gold, pyrite, metallic sulfide, chlorite and sericite~quartz stage, and is also the main gold metallogenetic phase.

2.3.5 Associated Components

Through spectral analysis of 22 samples and full chemical analysis of 1 ore sample, the chemical composition of ore is basically identified. The full chemical analysis of ore is listed in table 2-6, and spectral analysis in table 2-7.

Table 2-6 Full Chemical Analysis Result of Ore

Element Name	TFe	As	TiO_2	MgO	CaO	Al_2O_3	SiO_2	MnO
Content (%)	9.40	0.051	0.62	1.11	1.10	9.47	76.50	0.07
Element Name	Au	Ag	Cu	Zn	Pb	Sb	LOS	
Content (%)	5.02g/t	14.54g/t	0.03	0.05	0.06	0.003	0.91	

Table 2-7 Spectral Analysis Result of Ore (Unit: ppm)

Composition	Ag	Pb	Zn	Cu	Cr	Ni	Co	Ti	V
Average Content	0.00087	0.0087	0.00092	0.0191	0.0102	0.00108	0.00136	0.0448	0.0016
Composition	W	Sn	Mo	Bi	Zr	Y	As	Be	
Average Content	0.001	0.00176	0.0008	0.00292	0.00184	0.0006	0.004	0	

According to different ore types, the analysis of composite samples is performed to find out the content of beneficial and harmful substances and the result is listed in table 2-8.

Table 2-8 Analysis Result of Composite Samples

Sample ID	Element	Au	Ag	Pb	Zn	Cu	Sb	Mo	Co	WO_3	S	As	Remarks
	Mass Fraction	$\times10^{-6}$	$\times10^{-6}$	%	%	%	%	%	%	%	%	%	
Z1	Gold-bearing Quartz Vein	6.26	15.26	0.085	0.13	0.012	0.01	0.001	0.005	0.03	0.23	0.025	
Z2	Gold-bearing Quartz Vein	6.30	16.13	0.06	0.17	0.018	0.02	0.005	0.003	0.02	0.56	0.021	
Z3	Gold-bearing Quartz Vein	4.38	20.31	0.06	0.05	0.03	0.01	0.002	0.006	0.03	0.95	0.023	

The ore in this mine field has moderate gold grade and partially moderate to superior gold grade. The average grade of orebodies in each industrial ore vein is 4 .49$\times10^{-6}$ for the minimum and 6.56$\times10^{-6}$ for the maximum. The average grade of ore deposit is 6.21$\times10^{-6}$.

Associated silver in each ore vein changes a lot in content, and average silver content is 2.08$\times10^{-6}$ for the minimum, 37.9$\times10^{-6}$ for the maximum and 15.13~25.49$\times10^{-6}$ for the typical. There is no obvious correlation between gold and silver and the silver in the ore mainly has the following 2 sources: gold minerals and independent silver minerals. The silver in gold minerals and silver minerals respectively accounts for 50% or so and can be recovered during ore-dressing process, and most of it is lost during ore-dressing process.

Average sulfur content of each ore vein is 0.23~0.95% and fails to reach the requirement for the grade of elements associated with gold. The sulfur can't be comprehensively recovered, and is mainly from the pyrite in the ore and secondarily chalcopyrite, tetrahedrite, galenite and other sulfides.

The content of copper in each ore vein varies between 0.012% and 0.03%, and copper-bearing minerals mainly include the chalcopyrite, tetrahedrite, chalcocite and bornite.

The content of lead in each ore vein varies between 0.06% and 0.085%, and 0.05~0.17% for zinc content. The lead and zinc are closely related to the gold.

Chemical analysis shows that Au element is positively correlated with Ag, Cu and Pb contents, so the amount of metallic sulfides can serve as an important standard to determine the abundance of gold.

Beneficial and Harmful Components in the Ore

Besides gold element (average gold grade of mine field of 6.21×10^{-6}), main beneficial component in the ore is the silver, which can be viewed as the associated components, has the average grade of 16.88×10^{-6} and can reach the industrial requirement of associated component. Other beneficial components have very low content and no comprehensive utilization value. Beneficial components in the ore include the gold and silver, which take the form of native gold and electrum, are extremely easy to recovery and utilize and belong to free-milling ore.

The arsenic is the only harmful elements in the ore and is from mainly independent mineral - arsenopyrite, and secondarily pyrite and tetrahedrite. The arsenic has the content of only 0.021~0.025% and consequently belongs to low-harm ore.

2.3.6 Ore Type

1. Natural Type

According to mineral association of ore and gold occurrence, natural types of ore mainly include: gold-bearing pyritic quartz vein type ore and chalcopyritic pyrite gold-bearing quartz vein type ore, the former of which takes the predominant place. It can also be divided into compact massive ore and banded ore by ore texture and structure.

2. Industrial Type

Industrial type of ore is massive sulfide ore.

2.3.7 Wallrock and Gangue of Orebody

The wallrock of orebody is mainly of migmatized plagioclase hornblende gneiss, biotite hornblende plagiogneiss and migmatitic granite, is weakly altered, shows the sign of sericitization, chloritization, silification and pyritization, and has clear boundary between it and orebody.

455 samples for basic analysis are collected from the whole mine field and include 168 samples

from the earth's surface and exploratory trenches and 287 samples from the roof and floor of orebodies in the pit (including 129 wallrock samples). Among wallrock samples, there are 162 samples with gold content of 0.01×10^{-6}~0.20×10^{-6} and 20 samples with gold content of 0.2~0.8×10^{-6}. From the above figure, gold content of wallrock in the mine field is mostly below 0.2×10^{-6} (See table 2-9).

Due to the control of tenso-shear structures and the ramification and recombination of ore vein, the mineralization is uneven and the gangue occurs in the wallrock of ore vein. The gangue mostly takes the shape of lentil and lens, is mainly composed of various wallrock and altered wallrock, but is small-scaled. No gangue which can be eliminated is found in the orebodies.

Table 2-9 Chemical Analysis Result of Multiple Elements in the Ore

Rock Name	Element Content (%)							Total
	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	
Migmatized Plagioclase Hornblende Gneiss	64.76	0.50	17.01	1.17	4.09	0.05	3.23	
Biotite Hornblende Plagiogneiss	56.50	0.72	14.34	5.98	6.32	0.05	3.83	
Rock Name	Element Content (%)							
	CaO	Na_2O	K_2O	P_2O_5	Au	Ag	H_2O	
Migmatized Plagioclase Hornblende Gneiss	0.17	1.70	5.00	0.02	0.001	0.002	2.56	100.263
Biotite Hornblende Plagiogneiss	7.82	3.22	1.73	0.34	0.002	0.003	—	100.855

2.3.8 Genetic Type of Ore Deposit

1. The number of sulfur isotope is close to 0 and that of carbon isotope is -7‰ or so, indicating that the ore-forming is related to the magma. In addition, dike rock is developed in the mine field, granodiorite ($\pi\gamma\delta_5^{3-4}$) in the south of mine field ~ Duimiangou rock mass take the form of stock and are only 4km away from mine field, though no large rock mass crop out. It is thought that the formation of gold mine is related to it.

2. Ore-forming solution and components are mainly from the magma. The test of enciave samples from Ore Vein 51# in Jinchanggouliang Mine Field shows that quartz inclusion has gold content of 0.02ppb, which proves the above viewpoint. However, a large amount of surface water and components of wallrock are added to it. From δD~$\delta^{18}O$ correlation diagram, the hydrogen and oxygen isotopes of ore-forming solution lie in the lower left of the diagram, are far away from hydrogen and oxygen isotopic composition of metamorphic water, and are close to rainwater line, indicating that a large amount of atmospheric precipitation was added to hydrothermal ore-forming solution.

3. Physical-Chemical Condition of Ore Formation (table 2-10)

Table 2-10 Physical-Chemical Condition of Ore Formation

Average Temperature (℃)	Average Salinity (Wt%NaCl)	Average Density (g/cm^3)	Pressure (bar)	Depth (km)	Alkalinity Acidity (Ph)	Oxidation-Reduction Potential (Eh)		Oxygen Fugacity (fO_2)
						Eh1	Eh2	
196	6.70	0.94	538	1.8	5.83	-0.57--0.46	-0.4611	10^{-42}-10^{-49}

To sum up, the genetic type of this deposit is of moderate~low-temperature hydrothermal deposit (magma + a large amount of surface water).

2.3.9 Ore-hunting Indicator

1. In Duimiangou Mine Field, tectonic crushed altered rock and sulfide-bearing quartz vein in ancient metamorphic rock of Jianping Group of Archaean Era are the direct ore-hunting indicators.

2. There are small intrusions of Yanshanian granite, which provide heat source and part of ore source and are good ore-forming condition.

3. Structural indicator is NW- and near-SN-trending tensional and tenso-shear structures, which are good ore-hosting structures.

The above ore-hunting indicators form gold ore forming conditions and are good ore-hunting indicators. A small part of mine field is covered with Quaternary System, and geochemical exploration should be strengthened. Ore prospect is relatively wide.

3 Processing Performance

In November 2007, the owner of exploration right, Xinruien Mining Co., Ltd. in Aohan Banner entrusted Sinosteel Tianjin Geological Academy with the washability test of ore from Dongduimiangou Gold Mine Field in Aohan Banner so as to provide the basis for geological assessment and resource development and utilization.

3.1 Sampling Type, Method and Representativeness

The samples for ore-dressing test are collected from exploratory trenches and galleries by Xinruien Mining Co., Ltd. in Aohan Banner and weigh 550kg. The samples are mainly from Orebody 1# and secondarily from exploratory trenches in Orebodies 2#, 3# and 4#, are mixed with a small amount of wallrock (8% or so), get primary gold grade of 5.02×10^{-6} and associated silver grade of 14.56×10^{-6}, and basically have the representativeness.

3.2 Test Type, Method and Result

According to the requirements of Xinruien Mining Co., Ltd. in Aohan Banner, single floatation trial test is performed to the ore and the importance is attached to all-sliming cyanidation test.

1. Floatation Test

Testing conditions are shown as figure 3-1 and test results are listed in table 3-1.

Table 3-1 Result of Closed-circuit Test

Flow	Product Name	Yield (%)	Gold Grade (g/t)	Gold Recovery (%)
Single Floatation	Concentrate	4.04	101.36	81.56
	Tailing	95.96	0.98	18.43
	Raw Ore	100.00	5.02	100.00

From the above result of floatation test, the indexes for floatation process aren't ideal.

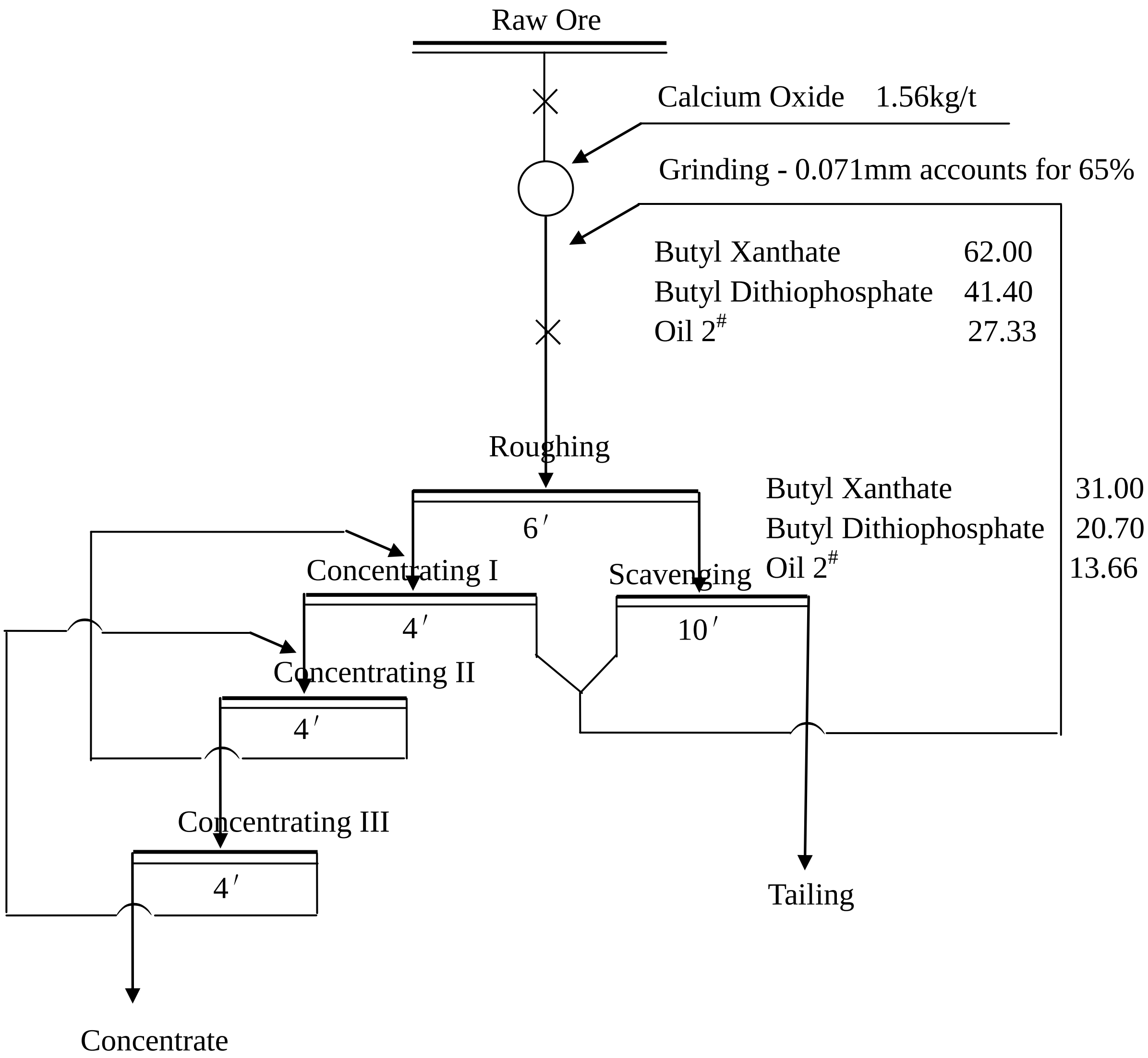


Figure 3-1 Close-circuit Flow of Single Floatation Process

2. All-sliming Cyanidation Test

According to the result of rock-mineral identification and ore properties, 1-stage grinding and 1-stage leaching-cyanidation process and 2-stage grinding and 2-stage leaching-cyanidation process are performed. The test result shows that it is relatively appropriate to use 1-stage grinding and 1-stage leaching-cyanidation process.

1) Grinding Fineness Test

Operating Condition: The concentration of leach pulp is 33#, the consumption is 800g/t for sodium cyanide (primary concentration of 0.03%) and 2.3kg/t for calcium oxide (concentration of 0.03%), and leaching time is 16 hours. Test result is listed in table 3-2.

Table 3-2 Relationship between Grinding Fineness and Leaching Rate

-0.071mm (%)	Leaching Time (h)	Primary Grade Au (g/t)	Grade of Leaching Residue Au (g/t)	Leaching Rate (%)	Remarks
65	8	5.02	0.50	89.96	Sampling
	12		0.28	94.51	Sampling
	16		0.28	94.51	Bulk Sample
75	8	5.02	0.28	94.51	Sampling
	12		0.28	94.51	Sampling
	16		0.28	94.51	Bulk Sample
86	8	5.02	0.50	89.98	Sampling
	12		0.24	95.16	Sampling
	16		0.16	96.77	Bulk Sample
93.20	8	5.02	0.50	90.32	Sampling
	12		0.16	96.77	Sampling
	16		0.16	96.77	Bulk Sample
97.02	8	5.02	0.28	94.51	Sampling
	12		0.16	96.77	Sampling
	16		0.16	96.97	Bulk Sample

The result of grinding fineness test shows that when the leaching time is 16 hours and grinding fineness of -0.071mm accounts for 86%, the gold grade of leaching residue can be reduced to 0.16g/t and gold leaching rate is up to 96.77%. Therefore, it is right that grinding fineness of -0.071mm accounts for 86%.

2) Test of Sodium Cyanide Consumption

Operating Condition: Fineness: -0.071mm accounts for 86%; Liquid to Solid Ratio: 2:1; Pulp Density: 33%; Consumption of Calcium Oxide: 2kg/t; and Leaching Time: 24 hours. It is possible to decrease the concentration of reagents and increase leaching time, so the leaching time is increased for relative low concentration of cyanides. Test result is listed in table 3-3.

The test result shows that it is appropriate to use the concentration of cyanide of 0.0168% and cyanide consumption of 400g/t.

Table 3-3 Relationship between Cyanide Consumption and Leaching Rate

Sodium Cyanide		Leaching Time (h)	Primary Grade Au (g/t)	Grade of Leaching Residue Au (g/t)	Leaching Rate (%)
Consumption (g/t)	Concentration (%)				
200	0.0084	16	5.02	1.92	61.82
		24		1.55	69.22

		28		1.55	69.22
300	0.0126	16	5.02	0.41	91.82
		24		0.41	91.82
		28		0.32	93.65
400	0.0168	16	5.02	0.16	96.77
		24		0.16	96.77
		28			
500	0.0210	16	5.02	0.15	96.79
		24		0.15	96.91
		28			

3) Test of Protective Alkali Consumption

Operating Condition: Grinding Fineness: -0.071mm accounts for 86%; Liquid to Solid Ratio: 2:1; Pulp Density: 33%; Consumption of Sodium Cyanide: 400g/t (concentration of 0.0168%); and Leaching Time: 16 hours. Test result is listed in table 3-4.

Table 3-4 Relationship between Protective Alkali Consumption and Leaching Rate

Calcium Oxidize		Primary Grade Au (g/t)	Grade of Leaching Residue Au (g/t)	Leaching Rate (%)
Consumption (kg/t)	Concentration (%)			
1.0	0.005	5.02	0.16	96.77
1.7	0.018	5.02	0.16	96.77
2.5	0.020	5.02	0.16	96.77
3.0	0.030	5.02	0.16	96.77

The test result shows that it is appropriate to use the concentration of calcium oxidize of 0.018% and calcium oxidize consumption of 1.7kg/t.

4) Test of Pulp Density

Operating Condition: Grinding Fineness: -0.071mm accounts for 86%; and Leaching Time: 16 hours. The concentration of leach pulp is tested. The test result is listed in table 3-5.

Table 3-5 Relationship between Pulp Density and Leaching Rate

Pulp Density (%)	Reagent Condition				Primary Grade Au (g/t)	Grade of Leaching Residue Au (g/t)	Leaching Rate (%)
	Sodium Cyanide		Calcium Oxide				
	Consumption (g/t)	Concentration (%)	Consumption (g/t)	Concentration (%)			
33	400	0.0168	1700	0.018	5.02	0.16	96.77

38	400	0.020	1700	0.025	5.02	0.16	96.77
45	400	0.025	1700	0.028	5.02	0.16	96.77
50	400	0.030	1700	0.032	5.02	0.26	94.82

The test result shows that it is perfect to use the pulp density of 45%. During actual production, the selection of pulp density can be determined according to the condition of production equipments.

5) Test of Leaching Time

Operating Condition: Grinding Fineness: -0.071mm accounts for 86%; Cyanide Consumption: 400g/t; Calcium Oxide Consumption: 1.7kg/t; Pulp Density: 45%; and Leaching Time: 4, 8, 12, 16, 20 and 24 hours. Test result is listed in table 3-6.

Table 3-6 Relationship between Leaching Time and Leaching Rate

Leaching Time (h)	Primary Grade Au (g/t)	Grade of Leaching Residue Au (g/t)	Leaching Rate (%)
4	5.02	0.49	90.30
8	5.02	0.29	94.16
12	5.02	0.16	96.77
16	5.02	0.16	96.77
20	5.02	0.16	96.77
24	5.02	0.16	96.77

The test result shows that the ore is relatively easy to leach and it is perfect to use the leaching time of 16 hours.

6) Zinc Dust Replacement Test

Replacement test is performed with zinc dust. Zinc dust is pretreated with 10% lead acetate and replaces pregnant solution with different cyanide concentration. Test result is listed in table 3-7.

Table 3-7 Result of Replacement Test at Different Cyanide Concentrations

Cyanide Concentration (%)	Oxygen Pumping Time (m)	Replacement Time (m)	Gold Grade of Pregnant Solution (g/M^3)	Gold Grade of Lean Solution (g/M^3)	Replacement Ratio (%)
0.01	30	30	4.12	0.11	97.33
0.03	30	30	4.12	0.03	99.27
0.05	30	30	4.12	0.03	99.27

Test result shows that the concentration of cyanide in pregnant solution should be over 0.03% and the replacement ratio of 99.27% can be reached.

7) Index for All-sliming Cyanidation Test

The indexes for all-sliming cyanidation test are listed in table 3-8.

Table 3-8 Result of All-sliming Cyanidation Test

Cyanidation Process						Replacement Process						Overall Recovery Rate (%)	
Primary Grade (g/t)		Grade of Leaching Residue (g/t)		Leaching Rate (%)		Grade of Pregnant Solution (g/m^3)		Grade of Lean Solution (g/m^3)		Replacement Ratio (%)			
Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag	Au	Ag
5.02	14.56	0.16	4.22	96.77	71.01	4.12	5.12	0.03	0.09	99.27	99.89	96.06	70.93

All-sliming cyanidation test realizes gold leaching rate of up to 96.77%, silver leaching rate of 71.01%, gold replacement ratio of 99.27%, silver replacement ratio of 99.89%, overall gold recovery rate of 96.06% and overall silver recovery rate of 70.93%. The consumption of cyanide for ore process is 369g/t. The consumption of bleaching powder for cyaniding is 3kg/t and it is agitated for 1 hour. The content of cyanide in treated lean solution is 0.02mg/l and reaches the state discharge standard.

All-sliming cyanidation test result shows that gold leaching rate and replacement ratio are good technical indicators. The flow of all-sliming cyanidation test is shows as figure 3-2.

8) Loopback Test of Lean Solution and Sewage Treatment Test

Test result shows that it is appropriate to return the lean solution at the rate of 50%. At this point, the consumption of cyanide for raw ore processing is 369g/t. The consumption of bleaching powder for cyaniding is 3kg/t and it is agitated for 1 hour. The content of cyanide in treated lean solution is 0.02mg/l and reaches the state discharge standard.

All-sliming cyanidation test result shows that gold leaching rate and replacement ratio are good technical indicators. The flow of all-sliming cyanidation test is shows as figure 3-2.

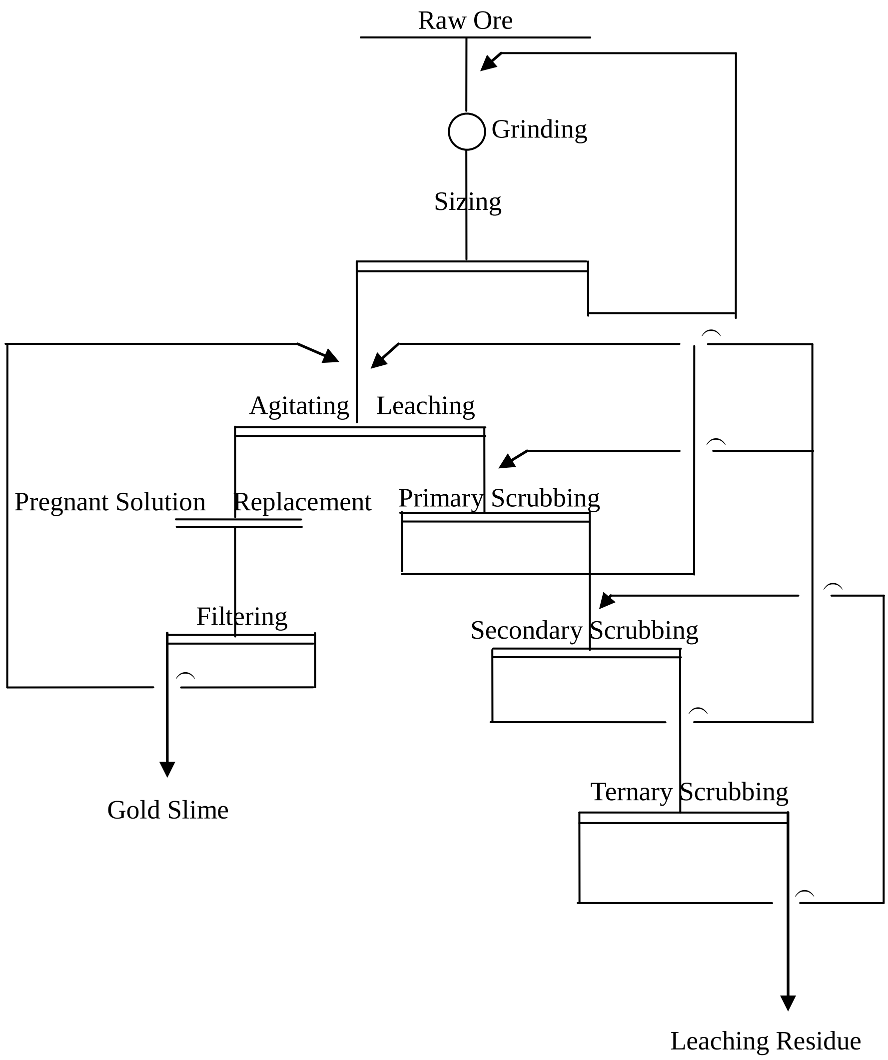


Figure 3-2 Flow Chart of All-sliming Cyanidation Test

3.3 Assessment on Industrial Utilization Performance of Ore

The ore-dressing test of gold ore shows that single floatation trial test doesn't produce ideal result and has the gold recovery of 81.56%. Since the native gold in the ore is mainly particulate and fine-grained, the effect of floatation isn't ideal. All-sliming cyanidation zinc dust replacement process has gold leaching rate of 96.77%, replacement ratio of 99.51%, overall gold recovery rate of 96.06%, gold grade of leaching residue of 0.16g/t, silver grade of leaching residue of 4.22g/t, overall silver recovery rate of 70.93%, and gets good effect of recovery. However, since the average grade of associated silver deposit is only 14.56g/t, the silver can only be recovered as much as possible. Test result shows that the ore is easy to wash, the gold can be well recovered, and associated silver can be also recovered and utilized. Therefore, the report on ore-dressing test can serve as the basis of geological assessment and ore-dressing process.

4 Technical Condition for Deposit Development

4.1 Hydrogeological Condition of Deposit

1. Landform, Climate and Surface Water of Mine Field

Mine field belongs to low mountainous area which features etching structure and is high in the east and low in the west, and the lowest erosion basis (elevation of 550m) - water shed of mine field - has the strike of near NW-SE. In the mine field, erosional cutting is intense, and the valleys are distributed in the shape of "V" and branch, have steep slope of 15°~25°, and are generally 3~5m (over 10m for individual sections) deep.

The mine field has the highest elevation of 875m, lowest elevation of 550m and relative height difference of 100~210m.

The mine field belongs to mid-temperate semi-arid continental climate and the atmospheric precipitation is the main recharge source of groundwater. According to the data from Chifeng Aohan Meteorological Bureau, it has the annual precipitation of 218.30~480.10mm and annual evaporation capacity of 2220.9~2920.8mm. The rain mainly falls in July to September, which is the main recharge period of groundwater. The variation in groundwater level is strictly controlled by the precipitation and generally varies between 1.2m and 2.4m. The range of variation in water level in different geomorphic units is different and it is slightly later than the precipitation.

Bedrock mountain area is the groundwater recharge runoff area. After the precipitation seeps in the ground, a small amount of it is discharged to the ravine in the form of spring and most of it recharges the loose aquifer in valley terrace in the form of underground flow. The groundwater recharges the surface water and the valley terrace is the runoff discharge area of groundwater.

There is no surface water body in the mine field. The orebodies lie above local erosion basis (elevation of 550m), so the groundwater won't influence deposit development.

2. Groundwater Recharge, Runoff and Discharge Conditions

Atmospheric precipitation is the only recharge source of groundwater in the mine field. Each aquifer in the area receives the recharge of atmospheric precipitation in the form of vertical seepage. Groundwater runoff condition is fully restrained by the landform and the groundwater flows from high place to low place. When water-bearing horizon is cut by the ravine, the groundwater is discharged to the earth's surface in the form of spring; otherwise, it will recharge Quaternary aquifer and finally river discharge area in the form of underground flow.

The whole mine field lies in medium-low mountainous area and hilly country and has good groundwater runoff and discharge conditions.

3. Aquifer in the Mine Field

The strata which crop out in the mine field is simplex and main aquifers include pore phreatic aquifer of Holocene Series of Quaternary System, granitic fissure phreatic aquifer of late Yanshanian Period and fissure phreatic aquifer of metamorphic rock series of Archaean Erathem.

1) Quarternary Pore Phreatic Water

It is distributed in the ravines, and the thickness of aquifer changes greatly with the fluctuation of bedrock surface and varies between 0.5m and 1.0m. It gets the lithology of detritus-bearing gritstone and great difference in grain size, mostly takes the shape of edge angle, and has extremely bad separation. The grains are mainly composed of various migmatized gneiss, granite and more. The content of detritus is about 3~5%, and 40~50% for gravel. The sand is mostly composed of feldspar, quartz and clastic fragment of various rocks, and has bad separation and psephicity. According to previous data on the mine field, water level is generally buried 2~3m below the earth's surface and the amount of water is small. When the dropdown of civil well is 0.74m, the water yield is 0.436L/s, 21.25m/d for permeability coefficient, 8.2 for PH value, 0.311g/L for the degree of mineralization, HCO_3—Ca·Na for groundwater chemical type, and 37.72m^3/d for single-well water yield.

2) Granitic Fissure Phreatic Water of Late Yanshanian Period

It is distributed in most of mine field, crops out at the elevation of 831~550m, and has the lithology of porphyritic granodiorite and porphyritic medium-fine-grained granite. The depth is 15~25m for weathered zone and 2~3m for intensely weathered zone. The rock in the weathered zone is crushed and fracture plane is obviously iron-stained. The rock below the weathered zone is intact and isn't developed with joint fissure. The buried depth of groundwater level is 5.85~11.85m and the aquifer is 7.80~15.00m thick. The data on pits show that water yield is 4.5~21.40m^3/d, 0.0058L/s·m for unit water yield and 9.00m for dropdown. It has the permeability coefficient is 0.0015m/d and weak water abundance and the hydrochemical type is of HCO_3~Ca type.

3) Fissure Phreatic Aquifer of Metamorphic Rock Series of Archaean Erathem

This set of rock formation is main wallrock where host gold orebodies and the weathering fissured zone is an important aquifer for deposit water-filling. According to hydrogeological engineering geological logging of galleries, weathered zone in this rock formation is 15.50~50m deep and has the elevation of 792~804.20m. The aquifer is 10.50~20.20m thick, 12.10~29.80m for the buried depth of groundwater and 0.022~0.506L/s for artesian flow. The data on galleries show that water yield is 6.91 m^3/d, 0.0114L/s·m for unit water yield and 0.0018m/d for permeability coefficient (K). The PH value is 8 and hydrochemical type of groundwater is HCO_3—Ca·Na·Mg type.

4. Aquiclude

There is no obvious aquiclude in this area. According to hydrogeological logging, below the weathered zone (below aquifer floor), the fissure isn't developed, and the rock is intact and can be viewed as relative aquiclude.

Direction of Water Supply: Ore-dressing plant is placed in Duimiangou Ravine on the south side of mine field, so the water in Quarternary pore aquifer near the mine field can provide the water for the production of the mine.

5. Observation of Water Yield

The mine field has simple hydrogeological conditions, and bedrock fissure water is the main aquifer for deposit water filling and has no other recharge source except for atmospheric precipitation. The observation of water yield in Middle Sections with the elevation of 633m, 593m and 553m shows that the pit in Middle Section with the elevation of 633m has the average water yield of 8.1m^3/d and maximum water yield of 11.2m^3/d (September), 15.2m^3/d and 17.8m^3/d (September) for Middle Section with the elevation of 593m, and 21.4m^3/d and 27.6m^3/d (September) for Middle Section with the elevation of 553m.

6. Comprehensive Utilization of Water Resource and the Direction of Water Supply

There is no surface water body in the mine field and the Quaternary pore water yield is less than 50m^3/d, which can hardly meet the demand for domestic water. Duimiangou on the south side of mine field has a large catchment area and the ravine is pretty long and is abundant in the groundwater in its downstream, which is high quality and is ideal water supply source for the production and living of the mine.

7. Hydrogeological Type of Mine Field

Through hydrogeological survey and collecting hydrogeologic data, the hydrogeological conditions of mine field is basically identified. Atmospheric precipitation is the main recharge source of groundwater, and Quaternary pore water-bearing deposit is thin and mainly contains bedrock fissure water. The deposit belongs to bedrock fissure water filling deposit, lies in semi-arid climatic region, gets the landform beneficial to atmospheric precipitation discharge, and has bad groundwater recharge condition. Wallrock weathering fissured zone has bad water abundance, and the orebodies lie above local erosion basis, and there is no surface water body. The mine field has simple hydrogeological conditions and belongs to Type I of Class II, namely bedrock fissure water filling deposit with simple hydrogeological condition, according to exploration type of water-filling deposit and complexity.

4.2 Engineering Geological Condition

4.2.1 Engineering Geologic Features of Mine Field

Engineering geological conditions of mine field are influenced and controlled by the structure, morphology of orebodies, lithology, degree of weathering and other factors, and the mine field can be divided into 3 areas by lithostratigraphic, physical and mechanic properties of rock.

1. Quaternary Loose Soft Rock Group

Quaternary eluvial-deluvial deposit, proluvial deposit, gritstone and sandy loam soil are distributed in the ravine, get loose structure, and are 5~10m thick. Gravel pebble gets great difference in diameter, have bad separation and bad engineering geological conditions, take the shape of edge angle, and belong to loose rock. 3~8m-thick loess is found in low-lying section of the ravine, belongs to soft bed and has bad engineering geological conditions.

2. Archaean Gneiss and Mesozoic Granite Type Hard Rock Group

Mesozoic granitic rock is widespread in the mine field, and Archaean gneiss and other metamorphic rock take the second place, have the main lithology of granodiorite, porphyritic granite, migmatized plagioclase hornblende gneiss, hornblende plagiogneiss, biotite plagioclase hornblende gneiss, migmatite and migmatitic granite, and get the natural lumpiness of 20~40cm and 1.00~2.00m for intensely weathered zone. After the weathering, initial rock is completely destroyed, changes in mineral composition and forms secondary clay minerals, and rock ore is soft and fragile. Weakly weathered zone is 2~48m thick, and the rock is slightly crushed, doesn't change in mineral composition and is stable and hard. NW- and NE-trending fissures are developed in the rock and fissure ratio is generally 3.92~7.96%. The rock in primary zone is intact and hard, and rock physical and mechanical test result of 3 samples is listed as follows:

Table 4-1 Rock Physical and Mechanical Test Result

Sampling Location	Lithology	Compressive Strength (MPa)	Tensile Strength (MPa)	Cohesinon Force (MPa)	Poisson's Ratio (μ)
Roof	Migmatized Plagioclase Horenblend Gneiss	165.98	3.72	12.86	0.28
Orebody	Vein Quartz	113.92	3.12	11.25	0.15
Floor	Hornblende Plagiogneiss	152.73	3.59	12.74	0.26

The observation of exploratory trenches and galleries shows that the rock is hard, is hard to crush and belongs to hard rock group.

3. Biotite Trachyandesite and Dike Rock Type Hard Rock Group

Biotite trachyandesite, granite pegmatite, orthophyre and more are found in the mine field. The earth's surface is weakly weathered. The natural lumpiness is 10~20cm and it crops out in a small area. During the detailed exploration, compressive strength, tensile strength and shear strength aren't tested. The observation of outcrops shows that the rock is weakly weathered, is hard, isn't easy to crush, and belongs to hard rock group.

4. Gold-bearing Quartz Vein Type Hard Rock Group

The earth's surface is weakly weathered, has few joints, and gets the natural lumpiness of 4~28cm. Intensely weathered zone is 0.2~2.00m deep, while the weakly weathered zone is 2~5m deep. Rock physical and mechanical test result is listed in table 6-1. The observation of exploratory trenches shows that the rock is hard and frangible, and should belong to hard rock group.

5. Shattered Fault Zone

Faulted structure isn't developed in the mine field and NW- and NEE-trending faults are found in this mine field. The fault at the earth's surface is 0.5~1.2m wide and tectonic fissures are developed on both sides of fault. The rock in the zone is crushed and should belong to weak formation.

4.2.2 Engineering Geological Condition and Assessment

The wallrock of orebodies is of Archaean metamorphic rock series and Mesozoic granite, is mainly composed of granodiorite, migmatized plagioclase hornblende gneiss, hornblende plagiogneiss and migmatite, and belongs to hard rock formation. The orebodies are controlled by the structures and occur in NW- and NEE-trending structures, and intensely weathered zone is 0.2~2.00m deep. During future underground development, the place 0~5m below the earth's surface should be concreted due to crushed rock in intensely weathered zone is crushed. The rock in the section over 5m below the earth's surface is hard and intact and timber support can be used for part of crushed section.

The first middle section basically lies in primary zone, and the wallrock may have the shattered fault zone and belongs to the area with unstable rock physical and mechanical properties due to wallrock joint. However, most of rock is intact and hard and isn't easy for bad engineering geological issues. When the mining operation advances on the earth's surface, rock weathering becomes intenser and intenser, the rock in the roof and floor has low stability and the caving, collapse, rib spalling and other bad engineering geologic hazards may happen, so it should be effectively supported.

4.2.3 Engineering Geological Type of the Deposit

The orebodies have the obliquity of 65°~76°. The overburden of the earth's surface is 1~3m deep and intensely weathered zone is 0.2~2.00m deep. The first middle section lies in primary zone, and the orebodies and wallrock all belong to hard rock group and have good rock physical and mechanical properties. Faulted structure isn't developed in the orebodies, which have simplex lithology. The rock has high stability and generally no engineering geologic hazard will occur. However, when the mining operation advances on the earth's surface, rock weathering becomes intenser and intenser, the rock becomes more and more crushed and decreases greatly in mechanical strength and the caving, collapse, rib spalling and other engineering geologic hazards may happen, so it should be effectively supported and effective safety measures should be taken. The mine field has simple engineering geological conditions.

4.3 Environmental Geology

1. Environmental Geologic Features

No destructive earthquake happened to this area and only an MS5.9 earthquake happened to the places 210km (linear distance) northwest of mine field on August 16, 2004. In one word, the recorded seismic activities near the mine field aren't intense. According to Seismic Ground Motion Parameter Zonation Map of China (GB18306-2001), this area has the seismic peak ground acceleration of 0.10g and basic seismic intensity of Grade VII, and belongs to basically stable area.

The mine field has open landform and slope angle of 15°~25°, belongs to continental monsoon climatic area, and is relatively arid. The evaporation capacity is higher than the precipitation, so mud-rock flow won't happen. Bedrock exposed area isn't steep, so gravity collapse won't occur.

The groundwater is basically unpolluted, has no color or smell, gets the PH value of 7.50~8.20 and the degree of mineralization of 0.311g/L, contains no toxic or harmful substance, and is good drinking water.

Dongduimiangou Gold Mine Field has 4 ore veins, belongs to hydrothermal fluid filling deposit and has compact structure and high hardness, and during underground mining, wet rock drilling should be adopted and labor protection should be strengthened to reduce the harm of dust.

During the mining, a large amount of waste rock will be discharged and should be piled up according to the requirements of administrative department so as to reduce the land occupied, avoid destructing the vegetation and prevent environmental pollution.

The tailings from ore-dressing plant should be piled up in the TSF in concentrative manner. Since all-sliming cyanidation method is used for ore processing, the tailings have severe toxicity and consequently the owner of the mine should construct the TSF strictly according to the regulation of related department, perform the reinforcement, heightening, flood control and antiseepage of tailing dam, and prevent waste water from ore-dressing process entering the earth's surface and polluting the groundwater. The TSF should be attended and monitored long-termly so as to prevent it from hurting the livestock and fowls.

According to 1:200,000 regional geologic survey, no radioactive hazard or radioactive pollution exists in this area.

Due to small scale of the deposit, as long as the requirements of environmental protection department are strictly met, environmental pollution won't occur.

2. Environmental Geological Type of Mine Field

Industrial wastewater and domestic wastewater should be discharged to the TSF in a concentrative manner. Tailing water should be treated and is discharged up to the standard. The antiseepage and leak resistance are performed to the bottom of the TSF and groundwater pollution isn't severe. Waste rock and tailings are piled up in concentrative manner. The mine field lies in semi-arid area, is surrounded by no pollution source, gets no surface water body and weak groundwater abundance, and has low possibility of geologic hazards and no radioactive hazard, and waste rock won't produce toxic or harmful components. In general, the deposit has Type-I geologic environment.

5 Verification Work and Quality Review

5.1 Resource Reserves Verification Method

During this resources/reserves verification, for the controlled orebodies being developed, we fully collected and sorted the data, conducted accurate measurement, performed engineering documentation, and accomplished trench sampling; and for newly-found ore-bodies, tracing method was used for exploration and all data are accurate and reliable.

5.2 Productive Exploration Method and the Principle of Engineering Layout

For the newly-found orebodies, each orebody is averagely arranged with 2 (or more than 2) prospecting works, which are laid on exploratory lines vertical to the strike of orebodies, and is numbered, sampled and assayed. 334-category resource reserves are estimated.

5.3 Review of Surveying Work

(1) Basis for Operation

①Specifications of Survey for Geological and Mineral Resources Exploration (GB1001-89) issued by the Ministry of Geology & Mineral Resources

②Specifications for Global Positioning System (GPS) Surveys (GB/T18314-2001) issued by State Bureau of Quality and Technical Supervision

(2) Coordinate System and Height System:

Beijing Coordinates System 1954 and National Height Datum 1985 are adopted. National Triangulation Station is used.

(3) Instruments:

S82 dual-frequency dynamic RTK1+3 receivers from South Survey & Mapping Instrument Co., Ltd. and Japanese Sokkia SET510 total stations are used.

5.4 Review of Geological Work

(1) Geologic mapping is to revise 1:10,000 geologic map in previous report.

(2) Geological logging, comprehensive sorting and the compilation of the report are finished in time. Initial and comprehensive data have clear maps, concise literal specifications and matched maps and literal specifications, and comply with the Specifications for Initial Geological Logging of Solid Mineral Exploration (DZ/T0078) and the Specifications for Comprehensive Sorting and Integrated Study of Geologic Data on Solid Mineral Exploration (DZ/T0079). The compilation of geologic report complies with the Specifications for Solid Mineral Resources Reserve Verification Report Compilation (GUOTUZIFA [2007] No.26) issued by the Ministry of Land and Resources and other regulations, and the quality of result basically meets the requirements of verification work.

(3) The samples collected with trench sampling method have the specification of 10×5cm and can guarantee the sampling quality.

6 Resource Reserves Estimation

6.1 Determination of Industrial Indexes

During this detailed exploration, the resource reserves of 26 orebodies in the mine field are estimated.

In reference to the Specifications for Hard-rock Gold Exploration (DZ/T0205-2002), the washability test of ore conducted by Sinosteel Tianjin Geological Academy shows that the ore is easy to wash. The owner of exploration right entrusted the Inner Mongolia Yuanbo Engineering Design Consulting Co., Ltd. with the prefeasibility study, which compiled the Plan for the Development and Utilization of Mineral Resources in Dongduimiangou Gold Mine, Aohan Banner, Inner Mongolia Autonomous Region to verify the industrial indexes. It is thought that under current technical and economic conditions, it is economical to develop this mine. It is reasonable to use current general industrial indexes. The industrial indexes examined and determined by the owner of exploration right are as follows:

1. Cut-off Grade: $\geq 1\times10^{-6}$

2. Minimum Industrial Grade: $\geq 2.5\times10^{-6}$

3. Average Grade of Ore Deposit: $\geq 4.5\times10^{-6}$

4. Minimum Minable Thickness: ≥0.8m

5. Gangue-eliminating Thickness: ≥2m

6. m·g·t value: 0.8×10^{-6} for cut-off value, 2.0×10^{-6} for minimum industrial value and 3.6×10^{-6} for the minimum of ore deposit

7. Eliminated Length of Block without the Ore:

10m (when the upper work corresponds to lower work)

20m (when the upper work doesn't correspond to lower work)

8. Associated Element: Assessment Index for Silver: ≥2g/t

9. Cut-off Grade of Oxidation Zone: $\geq 0.5\times10^{-6}$

For newly-found orebodies:

Resource Reserves = Strike Length × Dip Length × Average Thickness × Specific Gravity

Metal Reserves = Resource Reserves × Grade

During the prospecting, all the samples whose grade isn't less than cut-off grade are included into mineralized bodies (To better reflect the reality of mineralized bodies, individual extremely-high values are deleted.).

For the controlled orebodies being developed, the following method is used for resource reserves estimation.

6.2.1 Basis for the Selection of Calculation Method

1. Morphology and Scale of Orebody

Through geological works, 5 orebodies with industrial significance are determined in the mine field, all take the shape of vein or plate, and are 300~1400m long and averagely 0.7~1.01m thick.

2. Occurrence of Orebody

The orebodies have the obliquity of 68~80°, belong to vein orebodies, show the sign of swell-shrink at partial places, and take the form of mild undulance along the dip.

3. Variation in Thickness and Grade of Orebody

The earth’s surface of orebodies in the area is controlled with exploratory trenches, while the deep part is controlled with galleries. Systematic sampling, assaying and calculation show that the orebodies have the coefficient of variation in thickness of 90.56~112.28%, the coefficient of variation in Au grade of 135.66~156.02%, and belongs to relatively stable orebodies.

4. Degree of Exploration Engineering Control

The prospecting works are arranged according to the requirements of Type-III exploration. The strike length, thickness and variation in grade of orebodies at the earth’s surface are controlled with exploratory trenches. For the deep part, the strike length of orebodies is controlled by strike entry, the thickness and variation in grade by continuous sampling with the interval of 30m and boreholes, and depth extent by 40m-high (vertical height) middle section.

6.2.2 Determination of Resource Reserves Calculation Method

According to the above basis, the resource reserves are estimated with the method of geological block on vertical longitudinal projection map of orebodies. The formulas are as follows:

$$V = S \bullet M$$

$$Q = V \bullet D$$

$$P = Q \bullet C$$

Where, V - Volume (m^3)

Q - Charge of Ore (t)

P - Metal Reserves (kg)

S - Vertical Longitudinal Projection Area (m^2)

M - Average Horizontal Thickness (m)

C - Average Grade (g/t)

D - Average Specific Gravity of Orebodies (t/m^3)

6.3 Determination of the Parameters for Resource Reserves Estimation

6.3.1 Calculation of Average Grade

1. Average grade of single engineering (line transect) is calculated with length weighted method: the sum of the length of each sample multiplied by its grade is divided by the total length of all samples. The formula is as follows:

$$\overline{C} = \sum_{i=1}^{n}(liCi) \Big/ \sum_{i=1}^{n} li$$

Where, $\overline{\mathrm{C}}$ - Average Grade of Single Engineering (Line Transect) (g/t)

li - Length of Single Sample (m)

Ci - Grade of Single Sample (g/t)

2. Calculation of Average Grade of Ore Block

The engineering used for this exploration is exploratory trenches for the earth's surface and galleries for deep part, so when calculating the average grade of ore block, length weighted method is first used to calculate the average grade of each ore-controlling engineering, and then the method of arithmetic average is used to calculate the average grade of ore block.

The formula is as follows:

$$C_k = \frac{\sum_{i=1}^{n} \overline{c_i}}{n}$$

Where, C_k - Average Grade of Ore Block (g/t)

$\overline{c_i}$ - Average Grade of Single Engineering (g/t)

n - Number of Works Participating in the Calculation of Average Grade of Ore Block

When the intervals of upper and lower works are different, weighted average of grade of each layer should be calculated and then the average of the 2 layer is calculated.

3. Average Grade of Orebody

The average grade of orebody is equal to metal reserves divided by the charge of ore. The formula is as follows:

$$\overline{C} = \frac{P}{Q}$$

Where, $\overline{\mathrm{C}}$ - Average Grade of Orebody (g/t)

P - Metal Reserves (kg)

Q - Charge of Ore (t)

6.3.2 Determination of Block Area

CAD software is used of calculate the area of ore blocks delineated on vertical longitudinal projection map and each ore block is measured continuously 3 times, so the data are reliable.

6.3.3 Determination of Horizontal Thickness

1. Horizontal Thickness of Single Engineering

① Calculation of Horizontal Thickness of Line Transect in Exploratory Trench

The orebodies have steep occurrence, and the exploratory trenches are vertical to the strike of orebodies. The samples are all collected from one wall of exploratory trench with the channel sampling method, so sample length is the horizontal thickness of orebodies, and the horizontal thickness of line transect is the sum of sample length, namely horizontal thickness of single engineering.

② Determination of Horizontal Thickness of Line Transect in Pit (Horizontal Thickness of Single Engineering)

The pit is constructed along the level of orebodies, so the thickness of orebodies disclosed by vein-piercing pit is the horizontal thickness of orebody. The samples are collected along the direction vertical to the strike of orebodies, so sample length is the horizontal thickness of orebodies, and the horizontal thickness of line transect is the sum of sample length, namely horizontal thickness of single engineering.

6.3.4 Calculation of True Thickness of Orebody

1. Exploratory Trench and Pit:

$$M_1 = M \bullet \sin\alpha$$

Where, M_1 - True Thickness of Orebody (m)

M - Horizontal Thickness of Orebody (m)

α - Obliquity of Orebody (°)

6.3.5 Determination of Specific Gravity of Ore

The specific gravity in the report on detailed exploration is adopted and is 2.93t/m^3 for the average.

6.4 Principle of Orebody Delineation

The orebodies are delineated, connected and extrapolated according to the Specifications for Hard-rock Gold Exploration (DZ/T0205-2002), in combination with the characteristics of orebodies.

6.4.1 Orebody Delineation

During the prospecting, all the samples whose grade isn't less than cut-off grade are included in the orebodies. All the samples whose grade isn't less than industrial grade are included in industrial orebodies. If the orebody has the thickness of less than minimum minable thickness, but high grade, it is delineated with m·g·t value.

6.4.2 Connection of Orebody

According to spatial distribution rule of orebodies and change characteristics, the delineated orebodies are connected rationally and different works are connected with straight line.

6.4.3 Principle of Extrapolation of Orebody

1. Finite Extrapolation

According to the Specifications for Hard-rock Gold Exploration (DZ/T0205-2002), in combination with the characteristics of orebodies, the following principle of finite extrapolation is determined: when one of two adjacent works at the edge of orebody discloses the ore and the other doesn't, it is extrapolated by 1/2 of the spacing between the 2 works at the earth's surface and in vein-piercing pit, and 1/4 of the spacing between the 2 works on the vertical longitudinal projection map; when one work discloses the ore and the other discloses the mineralized bodies, it is extrapolated by 1/3 of the spacing between the 2 works.

2. Infinite Extrapolation

When the orebody isn't controlled by the work along the strike or dip, it is extrapolated by 1/4 of the spacing between the 2 works along the dip and strike on the basis of the controlled economic basic reserves (122b). When it doesn't reach the minimum minable thickness, the orebody delineated with m·g·t value isn't extrapolated.

6.4.4 Principle of Gangue Eliminating

The industrial indexes are strictly followed and that whose thickness isn't less than gangue-eliminating thickness should be eliminated.

6.5 Classification of Resource Reserves and Block Division

6.5.1 Classification of Resource Reserves

According to the regulation on the classification of resource reserves in the Specifications for Hard-rock Gold Exploration (DZ/T0205-2002), in combination with the degree of prospecting engineering control as well as the economic significance of ore deposit and feasibility assessment, it can classified into 2 categories:

1. Controlled Economic Basic Reserves (122b)

Resource reserves of this category have high degree of engineering control and the 4 sides of ore block are controlled by the work and samples. Resource reserves of this category are strictly controlled with Type-III exploration engineering grid of 40×40m (exploratory trenches for the earth's surface and pits for the deep part). The earth's surface is arranged with exploratory trenches, while the deep part is controlled with vein-piercing or line transect (single engineering) (middle section is 40m high).

2. Inferred Intrinsic Economic Resource Reserves (333)

Resource reserves of this category are extrapolated on the basis of (122b) resource reserves or pushdown to the deep part, have relatively low degree of engineering control, and are mainly distributed in finite extrapolation section of (122b) resource reserves in Orebody 1# and the section with relatively low degree of engineering control in the orebodies.

6.5.2 Principle of Block Division

In principle, ore blocks are divided along the works on exploratory lines or the work (line transect) close to exploratory line. On vertical longitudinal projection map, ore block of (122b) category is delineated with adjacent exploratory lines and the roofs of upper and lower pits. Ore block of (333) category is delineated with finite extrapolation and infinite extrapolation required by the specifications.

6.5.3 Problems on Resource Reserves Estimation

1. The closing date of resource reserves verification is the end of December, 2009.

2. This resource reserves verification basically refers to the data in the Report on Detailed Exploration of Dongduimiangou Gold Mine Field in Aohan Banner, Inner Mongolia Autonomous Region submitted by Inner Mongolia Tianxin Geological Exploration and Development Co., Ltd. in May 2008

3. The predicted resource reserves belongs to 334 category, and are based on the outcrops at the earth's surface, laboratory result of lump samples and Orebodies 2# and 3# whose deep parts aren't controlled by the work.

6.6 Result of Resource Reserves Estimation

6.6.1 Result of Accumulative Measured Resource Reserves in the Whole Area

Table 6-1 Result of Accumulative Measured Resource Reserves in the Whole Area

Resource Reserves of Each Category	Charge of Ore (t)	Metal Reserve (kg)	Grade (g/t)	Percentage (%)
122b+333+334	1903885	17754.3	9.33	100
122b	355838	2311.1	6.50	18.7
333	793919	8120.8	10.23	41.7
334	754128	7322.4	9.71	39.6

Table 6-2 Result of Accumulative Utilized Resource Reserves in the Whole Area

Resource Reserves of Each Category	Charge of Ore (t)	Metal Reserve (kg)	Grade (g/t)	Percentage (%)
122b+333	46880	412．0	8.79	100

122b	18000	117.0	6.50	38.4
333	28880	295.0	10.23	61.6

Table 6-3 Result of Accumulative Retained Resource Reserves in the Whole Area

Resource Reserves of Each Category	Charge of Ore (t)	Metal Reserve (kg)	Grade (g/t)	Percentage (%)
122b+333+334	1857005	17342.3	9.34	100
122b	337838	2194.1	6.50	18.2
333	765039	7825.8	10.23	41.2
334	754128	7322.4	9.71	40.6

7 Conclusion and Suggestions

7.1 Conclusion

1. Retained Resource Reserves:

(122b+333+334) gold ore reserves of 1,857,005t, gold metal of 17,342.3kg and Au average grade of 9.34g/t

Where:

122b Category: Gold ore reserves of 337,838t, gold metal of 2,194.1kg and Au average grade of 6.5g/t. It accounts for 18.2% of total resource reserves.

333 Category: Gold ore reserves of 765,039t, gold metal of 7,825.8kg and Au average grade of 10.23g/t. It accounts for 41.2% of total resource reserves.

334 Category: Gold ore reserves of 754,128t, gold metal of 7,322.3kg and Au average grade of 9.71g/t. It accounts for 40.6% of total resource reserves.

2. Utilized Ore Resource Reserves in the Whole Area:

(122b+333) ore reserves of 46880t, gold metal of 412kg and Au grade of 8.79 g/t

3) Accumulative Ore Resource Reserves:

(122b+333+334) ore reserves of 1,903,885t, gold metal of 17,754.3kg and Au average grade of 9.33g/t

Where:

(122b) Category: Gold ore reserves of 355,838t, Au metal of 2311.1kg and Au grade of 6.5g/t. It accounts for 18.7% of total resource reserves.

333 Category: Gold ore reserves of 793,919t, Au metal of 8,120.8kg and Au grade of 10.23g/t. It accounts for 41.7% of total resource reserves.

334 Category: Gold ore reserves of 754,128t, Au metal of 7,322.4kg and Au grade of 9.71g/t. It accounts for 39.6% of total resource reserves.

7.2 Suggestions

1. During this resources/reserves verification, 26 orebodies are discovered in this mine field, but a small amount of work load is invested and it lacks of effective prospecting means. There should be hidden orebodies in the mine field which aren’t discovered, so it is suggested that surface exposure and drilling engineering should be invested to realize better development and utilization.

2. The research shows that the orebodies in the mine field have at least 2 metallogenetic stages: ore veins (strike of NE) formed at the early metallogenetic stage are short and enriched, while ore veins (strike of NW) formed at the early metallogenetic stage are wide and lean and have large depth extent. Ore veins formed at the 2 stages obliquely cross each other.

3. It is suggested that the owner should strengthen the geological work of the mine should, perform essential work, and comprehensively analyze the geological problems found on site to provide the basis for ore mining and prospecting.

4. The safety management should be strengthened, especially slope management, ventilation and dust control.

5. Strengthen enterprise management and increase economic benefit.

6. In one word, this mine field gets dense ore veins, is abundant in resources, and has good ore-hunting prospect.