STATUS OF MINERAL EXPLORATION AND DEVELOPMENT IN ZIMBABWE

BY

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ZIMBABWE GEOLOGICAL SURVEY

SAIMM CONFERENCE,

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INTRODUCTION

MINING IN ZIMBABWE

STATUS OF BASELINE GEOLOGICAL DATA

LEGISLATIVE FRAMEWORK FOR MINERAL EXPLORATION

EXPLORATION TITLES AND HISTORICAL TRENDS

EXPLORATION EXPENDITURE AND ACHIEVEMENTS

HIGHLIGHTS OF SOME EXPLORATION AND DEVELOPMENT PROJECTS

FUTURE OUTLOOK & CONCLUSION
INTRODUCTION

- Mining industry currently Zimbabwe’s biggest target by international investors
- Mineral exports account for over 50% of the country’s foreign exports earnings.
- The mining sector employs over 45 000 people formally and more than 500 000 informally.
- Long history of mineral exploration and mining
- >40 different minerals are known and have been mined at one point in time.
MINING IN ZIMBABWE

- Credited for most of present-day infrastructure in Zimbabwe.
- Majority of towns and cities developed in the vicinity of mining areas e.g Hwange, Kadoma, Kwekwe etc.
- Most railway line branches and some major roads were constructed to serve mining areas.
- Many industries arose through mining industry’s needs.
- The mining sector continues to act as a magnet for investment in Zimbabwe.
Geology spanning >3000 Ma. Highly conducive for diversity of minerals.

Divided into three main eras;

1. The Archean

- Also known as the Zimbabwe Craton
- An Archaean Basement principally composed of granites and gneisses with remnants of volcano-sedimentary piles known as Greenstone Belts.
- Covers 60% of the country, central in location.

Status of mineral resource exploration and development in Zimbabwe
2. The Proterozoic

- Marked by the Great Dyke, a NNE-trending intrusion of mafic-ultramafic layered rocks
- Emplaced at the end of the Archean era (2 500 million years ago)
- 550km long and 4-11km wide
- Cuts across the entire Craton roughly in a N-S direction.
- Three Proterozoic Metamorphic/”Mobile” Belts surround the Craton to the north east, south, and north-west.
- The metamorphic belts are rich in economic metamorphic minerals and host several gemstones, precious and base metal mines.
3. The Phanerozoic

- Consists of several sequences of sedimentary rocks covering the peripheries of the Craton
- Includes Sedimentary basins, the Permian –Triassic Jurassic Karoo Supergroup, Cretaceous sediments, and Tertiary to Recent sands of the Kalahari
- Post Karoo intrusives; various granitic rocks in the southern part of the country, alkali ring complexes, and kimberlites
ZIMBABWE GEOLOGICAL MAP

Scale of Kilometres

An overview of mineral resource exploration and development in Zimbabwe.
Mineral deposits of Zimbabwe are amongst the best documented in the region, and a search through the available literature always forms the first stage in exploration of any mineral.

Baseline geological, geophysical, geochemical, Remote sensing data is necessary at this stage.
Geological Surveys provide pre-competitive geoscientific information used by exploration companies.
About 60 - 65% of the country has been mapped in detail.

Each block has been mapped at a scale of 1:50 000 but maps published at 1:100 000 accompanied by a descriptive text.
GEOCHEMICAL MAPPING

Two Geochemical mapping levels
National Scale: Zimbabwe National Low Density Mapping Project.
  Cover whole country average sample density: 1 sample/ 2000 km²
  Sample media: floodplain/overbank sediment
  Total sampling sites: 200
  Chemical analysis: 41 elements;
STATUS OF BASELINE GEOLOGICAL DATA

- GEOCHEMICAL MAPPING

Regional Scale
Regional Geochemical Mapping Project in Chimanimani Area, Harare and Gweru
Area: 10 400 km²
Mapping scale: 1:250 000
Sampling density: 1 sample/4 km²
Sampling media: stream sediments
39 elements were analyzed
Aero-Magnetics
- At height of 305 m
- Line spacing of 1 km
- About 95% of the country covered
STATUS OF BASELINE GEOLOGICAL DATA

- Gravity Survey

SEISMIC LINES done during Oil exploration

- rock density contrasts
- Ground stations from 1 per km\(^2\) to 1 per 100 km\(^2\)

Status of mineral resource exploration and development in Zimbabwe
Large scale exploration carried out under licenses issued by the Head of State and administered by the Mining Affairs Board (MAB) as per the provisions of Mines and Minerals Act (ch.21:05)

Large scale exploration licenses issued under two titles, depending on the mineral to be explored;

1. Special Grant (SG) for energy minerals which include Coal, CBM, Natural Gas, Oil and Uranium.
2) Exclusive Prospecting Order (EPO) for all other minerals including base metals, gold, diamond etc.

Type of license introduced in 1947.

Over 1600 large scale exploration licenses have been issued to date.
• Preliminary exploration covering whole country done at one point or another.
• History of exploration dates back to the 19th century.
• Over 4000 Mineral deposits known from ancient workings.
• Current exploration activities biased towards rediscovering ancient workings.
• Exploration led to discovery of several major mines some of which are still operating to date, e.g. Zimplats, Murowa Diamonds, Freda Rebecca, Hwange Colliery.
status of mineral resource exploration and development in Zimbabwe

Legislative Framework for Mineral Exploration

non systematic exploration activities

• Exploration in claims which are mining titles – the results of this exploration which is usually meant for mine development is normally not reported.

• Special grants in reserved areas – the reporting is also non systematic in nature.
STATUS OF EXPLORATION TITLES

EXCLUSIVE PROSPECTING ORDERS (EPOs)
- Number current = 0
- Number pending applications = 34
- Number pending approval for renewal = 3

SPECIAL GRANTS (Part XX) of MMA
- Number current = 18
- Number pending applications = 35
- Number pending approval for renewal = 20
STATUS OF EXPLORATION TITLES

Exclusive Prospecting Orders

Status of mineral resource exploration and development in Zimbabwe
The past century commencing in 1910 coinciding with the establishment of the Zimbabwe Geological Survey was characterized by distinct phases of prospecting interest. There was a peak activity in the 1960s to early 1970s reflecting a world trend in increased exploration, notably for base metals. The years 1968-75 constituted the nickel boom with Ni/Cu by far the most popular target over that period in Zimbabwe.
HISTORICAL EXPLORATION TRENDS

• The decade, coinciding with the first of ten years of the country’s independence, has had its ups and downs in the exploration sphere.

• There was an initial rush in E.P.O applications and exploration activities in 1980 and 1981, much of this work being aimed at re-establishing previously suspended programmes as a result of insecurity caused by the war of independence.

• All mineral categories were targets, although Coal and Uranium were topping the list. The falling base mineral prices in the mid 1980s resulted in drastic drop in activity.
**HISTORICAL EXPLORATION TRENDS**

- The fall in gold prices in the early 1988, resulted in a change of emphasis in 1989 with more than ten E.P.O holders specifically selecting Platinum as a target mineral.
- In the early 1990s there was a growing interest in diamond exploration encouraged by the opening of the River Ranch diamond mine near Beitbridge.
- There was also an interest in gas exploration in Zimbabwe in the early 1990s with major focus being on Coal Bed Methane (CBM).
- Significant CBM resource has since been established but development to critical stage of proving the commercial viability of the gas is still lagging behind.
HISTORICAL EXPLORATION TRENDS

- An important event in the exploration history of the country was marked by the availability of the Canadian International Development Agency (CIDA) sponsored aeromagnetic data on Zimbabwe in the 1990s.
- The data attracted several exploration companies to venture into areas that had previously been ignored. This was especially for the western parts of the country covered by Kalahari sands.
- The data also triggered diamond exploration.
### SYSTEMATIC EXPLORATION EXPENDITURES

<table>
<thead>
<tr>
<th>YEAR</th>
<th>NO. CURRENT EPOS BY END OF YEAR</th>
<th>NO. CURRENT SGS BY END OF YEAR</th>
<th>TOTAL NO. OF EXPLORATION TITLES</th>
<th>ANNUAL EXPLORATION EXPENDITURE (US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>2</td>
<td>31</td>
<td>33</td>
<td>107 731+</td>
</tr>
<tr>
<td>2010</td>
<td>0</td>
<td>16</td>
<td>16</td>
<td>2 066 172+</td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
<td>23</td>
<td>23</td>
<td>19 901 285+</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>27</td>
<td>27</td>
<td>11 850 368+</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>11</td>
<td>11</td>
<td>29 323 969+</td>
</tr>
<tr>
<td>2014</td>
<td>4</td>
<td>18</td>
<td>22</td>
<td>1 017 593+</td>
</tr>
<tr>
<td>2015</td>
<td>3</td>
<td>21</td>
<td>24</td>
<td>112 182+</td>
</tr>
<tr>
<td>2016</td>
<td>3</td>
<td>24</td>
<td>27</td>
<td>46 645+</td>
</tr>
</tbody>
</table>

(August)

Status of mineral resource exploration and development in Zimbabwe
ACHIEVEMENTS OF EXPLORATION

- Work carried out during the tenure of EPOs has over the years been translated into numerous successful mining ventures (Next Slide).
- Mines brought into production fall into two categories; (a) those where mineralization was not known prior to the granting of the order, (b) and those where it was known to be present, and in which the order enabled the deposit, and the surrounding country, to be thoroughly prospected and delimited without hinderance by speculators.

The success rate for exploration in Zimbabwe was at 3.9% by 1984 which is quite high by global standards.
<table>
<thead>
<tr>
<th>Exclusive Prospecting Order (EPO) no.</th>
<th>Mine Opened/Discoveries</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>Perseverance nickel mine, Delcia gold mine</td>
</tr>
<tr>
<td>137</td>
<td>Shackleton Copper Mine, Avondale copper</td>
</tr>
<tr>
<td>92-3, 97-8 and 113-7</td>
<td>Sandawana Emerald Mine</td>
</tr>
<tr>
<td>4,42 and 82</td>
<td>Mhangura and Nora copper mines</td>
</tr>
<tr>
<td>3 and 16</td>
<td>Silverside Copper Mine</td>
</tr>
<tr>
<td>15</td>
<td>Umkondo Copper Mine</td>
</tr>
<tr>
<td>24 and 28</td>
<td>Buchwa Iron ore mine</td>
</tr>
<tr>
<td>11</td>
<td>Orpheus iron ore deposit</td>
</tr>
<tr>
<td>35</td>
<td>Alaska copper mine</td>
</tr>
<tr>
<td>39</td>
<td>Empress nickel Mine</td>
</tr>
<tr>
<td>57</td>
<td>Inyala chrome mine</td>
</tr>
<tr>
<td>79</td>
<td>Chegutu Limestone deposit</td>
</tr>
<tr>
<td>80</td>
<td>Shamrocke copper mine</td>
</tr>
<tr>
<td>55,72 and 178</td>
<td>Trojan Nickel Mine</td>
</tr>
<tr>
<td>104 and 184</td>
<td>Madziwa nickel Mine</td>
</tr>
<tr>
<td>169 and 231</td>
<td>Shamva-Cymric Mine</td>
</tr>
<tr>
<td>171</td>
<td>Jannasch gold mine</td>
</tr>
<tr>
<td>181 and 195</td>
<td>Gwaai River Copper mine</td>
</tr>
<tr>
<td>204</td>
<td>Inyati Copper mine (headlands)</td>
</tr>
<tr>
<td>239</td>
<td>Epoch Nickel deposit</td>
</tr>
<tr>
<td>233 and 352</td>
<td>Shangani Nickel deposit</td>
</tr>
<tr>
<td>22,27,77 and 78</td>
<td>Copper Queen and Copper King mines</td>
</tr>
<tr>
<td>13</td>
<td>Lubimbi coalfield</td>
</tr>
<tr>
<td>19</td>
<td>Tuli coalfield</td>
</tr>
<tr>
<td>50 and 112</td>
<td>Bubye Coalfield</td>
</tr>
<tr>
<td>127,128,130,188,189,194,203 and 260</td>
<td>Great Dyke Platinum-nickel-copper deposits</td>
</tr>
<tr>
<td>391 and 406</td>
<td>Zinc mineralization in the eastern portion of the Zambezi Metamorphic Belt</td>
</tr>
<tr>
<td>446</td>
<td>Sengwa Coal deposit (Sengwa coal mine)</td>
</tr>
<tr>
<td>578</td>
<td>Kanyemba Uranium Deposit</td>
</tr>
<tr>
<td>601</td>
<td>Royal family gold mine</td>
</tr>
<tr>
<td>613</td>
<td>Freda Rebecca mine</td>
</tr>
<tr>
<td>628</td>
<td>Expansion of golden Kopje gold mine</td>
</tr>
<tr>
<td>629</td>
<td>Expansion of Blanket gold mine</td>
</tr>
<tr>
<td>654</td>
<td>Platinum resources in the Snakes Head (Great Dyke)</td>
</tr>
<tr>
<td>689</td>
<td>Considerable gold resources in the Dindi Greenstone belt were discovered.</td>
</tr>
<tr>
<td>692</td>
<td>Development One Step gold deposit</td>
</tr>
<tr>
<td>721</td>
<td>Maligreen gold mine</td>
</tr>
<tr>
<td>745</td>
<td>Development of Peach Tree mine</td>
</tr>
<tr>
<td>753</td>
<td>Ipanema and Hungwe gold discoveries</td>
</tr>
<tr>
<td>831</td>
<td>Discovery and establishment of the Bubi Mine Prospect</td>
</tr>
<tr>
<td>847</td>
<td>Renco Gold mine</td>
</tr>
</tbody>
</table>
HIGHLIGHTS OF SOME EXPLORATION AND DEVELOPMENT PROJECTS

- **Platinum Group Metals (PGMs):** The Great Dyke hosts world’s second largest reserves of PGM after the Bushveld Igneous Complex of RSA.
- **2.8 billion tonnes PGM ore @ 4g/t 4e on the Great Dyke**
- **Two PGM-bearing horizons are the Main Sulphide Zone (MSZ) and the Lower Sulphide Zone (LSZ)**
- **Current mining is focused on the MSZ while LSZ is still to be investigated in greater detail.**
- **Potential of other layered igneous complexes not been explored.**
HIGHLIGHTS OF MAJOR EXPLORATION AND DEVELOPMENT PROJECTS

An overview of mineral resource exploration and development in Zimbabwe

- Zimplats
- Todal

Location Map of the Great Dyke Platinum Projects

- Snake Head Project
- Zimplats
- Ngezi Mine
- Todal
- Unki
- Mimosa Mine

Explanation:
- Towns
- Roads
- Railway
- Platinum Area
- Great Dyke

Figure 1
HIGHLIGHTS OF SOME EXPLORATION AND DEVELOPMENT PROJECTS

- **GOLD**
- > 4 000 recorded gold deposits, nearly all of them located on ancient workings.
- The country remains under-explored to discover deposits away from these ancient workings.
- Other gold deposits occur in the Limpopo mobile Belt in the south of the country and Proterozoic Piriwiri rocks in the North western part of the country.
- The Umkondo Group - Chimanimani is a new gold province that requires systematic exploration.
- Rivers such as Mutare, Angwa and Mazowe also requires exploration for alluvial gold.
Areas for systematic exploration
HIGHLIGHTS OF SOME EXPLORATION AND DEVELOPMENT PROJECTS

- **DIAMONDS**
- Diamonds are a gemstone of enormous potential in Zimbabwe.
- Globally economic kimberlites are commonly found in ancient cratons such as the Kaapvaal, the Siberia and the Congo cratons.
- With similar geology to these areas, the well exposed Zimbabwe craton presents vast opportunities for kimberlitic diamond discoveries.
- Over 150 kimberlites have been discovered to date whose economic and commercial viability is yet to be ascertained.
- The discovery of a world class placer diamond deposit in 2006 points to significant potential in ancient basins on the edges of the craton.
Status of mineral resource exploration and development in Zimbabwe
An overview of mineral resource exploration and development in Zimbabwe

Kimberlite Occurrences in Zimbabwe

EXPLANATION
- Green Triangle: Placer-Type Diamonds
- Purple Star: Kimberlite
- Red Square: Town
- Red Line: Road
- Blue Line: River
- Cyan Area: Lake

Map showing Kimberlite occurrences in Zimbabwe with locations marked by stars.
HIGHLIGHTS OF SOME EXPLORATION AND DEVELOPMENT PROJECTS

- NICKEL
- The geology of Zimbabwe is highly favourable for nickel occurrences.
- The country’s nickel sulphide endowment includes a variety of komatiite and mafic intrusion-hosted deposits.
- Other sources of nickel are the huge laterite deposits on the northern part of the Great Dyke.
- Explored deposits include Hunter’s Road & Perseverance.
An overview of mineral resource exploration and development in Zimbabwe.
HIGHLIGHTS OF SOME EXPLORATION AND DEVELOPMENT PROJECTS

• COAL

• Large in-situ reserves in Lower Karoo of the mid Zambezi & the Save-Limpopo basins.

• Estimated resources of >26 billion tonnes

• The Hwange area hosts large reserves of both coking and thermal coal.

• Despite the widespread occurrence, development and production has so far been confined to Hwange.

• There has recently been some small production from the Tuli and Mkwasine coalfields.

Status of mineral resource exploration and development in Zimbabwe
Status of mineral resource exploration and development in Zimbabwe
HIGHLIGHTS OF SOME EXPLORATION AND DEVELOPMENT PROJECTS

- Coal Bed Methane:
  - Potential resource areas have been identified but commercial viability of the gas is still to be assessed.
  - Quality of CBM is good. About 95% methane, 4% Nitrogen and 1% shared by Ethane, Carbon Dioxide and Oxygen.
  - CBM resource is estimated at > 20 Trillion Cubic Feet (TCF).
  - Pilot Production wells have been drilled and currently being tested in Lupane.

Status of mineral resource exploration and development in Zimbabwe
HIGHLIGHTS OF SOME EXPLORATION AND DEVELOPMENT PROJECTS

Coal Bed Methane:
An overview of mineral resource exploration and development in Zimbabwe
Zimbabwe’s Mining Development Situation as of July 2017

Exploration
- Score Minerals
- McShane Investments
- ITS Architects
- Shangani Energy Exploration
- Kanyemba
- Kateite
- Tuli Coal
- Coal
- CBM
- Diamonds
- Cu/Ni
- W
- Uranium
- REE
- PGM
- Gold

Pre-feasibility
- Devuli Range
- Monaf (>100)
- Apex Petroleum (>30)
- Markrock Mining (>20)

Feasibility
- China Africa Sunlight Energy
- Sengwa
- Veriﬁy Engineering
- Hunters Road
- Discovery Investments

Project Financing
- Sese
- Liberation
- Mimosa
- Zambezi Gas

Development
- Unki
- Consolidated Diamond Company (ZCDC)
- Murowa
- Zimplats
- Makomo Resources
- Steelmakers
- Hwange Colliery Company
- Freda Rebecca
- Great Dyke

Production
- Shangani Energy Exploration
- Tuli Coal
- Todal Mining
- GPR
- Trojan
- Redwing
- Renco
- Jena
- Muriel
- Mazowe
- Shamva
- Chakari

Closure
- RHA
- River Ranch
- Mhangura
- Inyati

Coal

CBM

Cu/Ni

W

Uranium

REE

PGM

Gold
FUTURE EXPLORATION OUTLOOK

GRASSROOTS EXPLORATION

- Existence of so many known mineral deposits made exploration in virgin areas unnecessary for a number of minerals.

- Exploration biased at re-discovering old workings.

- All known mineral deposits are potential areas for detailed grassroots exploration in respect of larger deposits.

- We usually find economic mineral deposits in a new place with old ideas. Sometimes, we find economic mineral deposits in an old place with a new idea, but we seldom find much economic mineral deposits in an old place with an old idea.
CONCLUSION

- Country conducive to discovery of world-class mineral deposits.
- There has been little exploration outside known deposits.
- With huge historical data on mineral occurrences, and usage of modern exploration techniques, the full potential is still to be realized.
- The future of exploration in Zimbabwe is very bright if we invest in modern ideas of exploration.
Thank You