BUSITEMA UNIVERSITY
Pursuing Excellence

FACULTY OF ENGINEERING

DEPARTMENT OF MINING AND WATER RESOURCES ENGINEERING

ORE RESERVE ESTIMATION

CASE STUDY AREA: AFRICAN PANTHER RESOURCES UGANDA KIKAGATI TINE MINE

BY

RICHARD KIDEGA

BU/UP/2013/211

TEL: +256773773472

Email: kidegarichard94@gmail.com

SUPERVISORS:

MAIN SUPERVISOR: MR. NASASIRA HILARY

CO SUPERVISOR: MISS NANGENDO JACQUELINE

A final project report submitted to the Department of Mining and Water Resources Engineering in Partial Fulfillment of the Requirement for the Award of a Bachelor of Science Degree in Mining Engineering.

May, 2017

ABSTRACT

The feasibility and pronouncement to invest in the mining industry comes with all forms of challenges that will have to be managed with care. Chiefly because, it involves huge capital disbursement and the associated risks are very high.

The valuation process of the commercial viability of the ore deposit consists of two major components; the estimation of the quantity (including quality) of the commodity and the decision as to whether or not to mine (or invest).

This study estimated the tin ore reserve using triangulation method. These involved the valuation of the average grade, tonnage, areal extends of the deposit, the stratigraphic column characteristic of the deposit and the approval based on the exploration work done by the company.

The decision to do detailed exploration or to abandon the mine was made with the help of the estimated ore reserve parameters, taking into consideration the prevailing cutoff grade for cassiterite.

The results indicate that, the average grade is 0.033% cassiterite which is below the cutoff grade of 0.5% cassiterite, therefore it's recommended that the company do detailed exploration and if the exploration results is still no sustainable, the mine is to be abandoned.

BUSITEMA UNIVERSITY

DECLARATION

I Kidega Richard, hereby affirm that this project proposal report is my original work with the omission where references have been made and it has not been presented to any establishment of higher learning for any academic award.

Sign: .....

Date: 30/05/2017

REG. NO BU/UP/2013/211

ACKNOWLEDGEMENT

Utmost significantly, I am grateful to God for the aptitude of life and ingenuity He has unfilled me to finish this project report and gather all the necessary knowledge to compile it. My heartfelt indebtedness goes to my supervisors Mr. Hilary Nasasira and Ms. Nangendo Jacqueline for the management and time they offered me in completing this project.

I am impressively beholden to my parents and guidance; Miss Auma Margret, Amuron, Mr. Okello Charles and Mr. Otto Wilfred and the family members. They have been there for me amidst all challenges. In paucity of means, they have forfeited their time, secure their advice and the precise last of their possessions for me. Confidently, there is naught I can give as a remuneration to them other than praying for God's frugality and blessings upon them.

I furthermore be indebted gratitude to all the lecturers in the department of mining and water resources engineering for example; Mr. Tugume Wycliffe, Mr. Wangi Mario, Mr. Lwanyaga J. Ddumba, Mr. Mugisha Moses among others and my companion students to their irreplaceable peculiarity of knowledgeable sustenance, team work and the indispensable guidance they furnished me with in the course of my academic contract.

African Panther Resources Uganda Kikagati Tin Mine (APRU) for their provision in the completion of the schoolwork.

BUSITEMA UNIVERSITY

APPROVAL

This is to attest that the project proposal report titled "ORE RESERVE ESTIMATION" has been under supervision and is acquiesced to the board of examiners with my endorsement.

Mr. Hilary Nasasira

Department of Mining and Water Resources Engineering

Sign: .....

Date: .....

Ms. Nangendo Jacqueline

Department of Mining and Water Resources Engineering

Sign: .....

Date: .....

LIST OF FIGURES

TABLE CONTENTS

CHAPTER ONE: INTRODUCTION

1.0 Introduction

This chapter comprises of the background of the study, problem statement, objectives of the study, justification and the scope.

1.1 Background

Ore reserve estimation has a crucial importance for the evaluation and exploitation of mineral deposit. Reserve estimation is based on the results of *exploration*, such as drill holes and exploratory drift located in grid. Several variables concerning exploration works are proposed as representation for mineralization and for mineralization intensity and for calculating reserve. These variables generally include the ore thickness in the exploration works and the grade over this thickness (Erarslan, 2008).

Since reserve estimate is the primary input in to any financial analysis and feasibility of a mining project but significant effort is often expanded on capital and operating cost estimation, commodity price forecast, and choice of discount rate while uncertainty in the primary input, the reserve is completely overlook the significance of uncertainty in the reserve estimate is highlighted by (Group de Reflexion, 2008) Who reported that, among small mining companies in South Africa during the 1980s, 70% failed mainly because of over estimation of the ore reserve tonnage and grade.

(Goodman and Co., 1995) Error constructed a summary of North America mines failures listing 40 mines that were then running at only 25% of the capital invested in them. On the basis of feasibility study or investment analysis, the reserve on which the capital investment decision was made can only be assumed to be far greater than the actual achieved by mining.

African panther resources Uganda is a tin mining company currently carrying out mining and exploration in Kikagati tine mine, located in Isingiro District. The reserve for the tin deposit is inappropriately appraised and this therefore needs for rectification. This is not due to the used the wrong method but because the estimation was over looked.

Practicality of mining and/or processing are important considerations in the estimation of a mineral reserve. Careful selection of the mining equipment selected for appropriate deposit is based on the reserve estimated. Inappropriate mining method and equipment selection have an effect on both dilution and extraction.

The key objective of mineral reserve estimation is the successful extraction and delivery of mineral resource for processing at the grade estimated. Due consideration should be given to the problem associated with selective mining where the cut-off grade is set high selective to the average grade of the mineral.

Therefore, this study estimates the geological interpretation, mineral inventory and also encompasses the modeling of the deposit which helps in decision making as to where to develop the mine for extraction, further detailed exploration or whether to abandon.

1.2 Problem Statement

African panther resources is tin mining company which has continuously been extracting ore below the cutoff grade. This is making the company to suffer expenses which is not generating profit. This has also cost slow production.

Poor quantification of the ore reserve (over estimation) could be the cause therefore there is need to estimate the reserve and recommend if the company can abandon the mine or invest in more detailed exploration to appraise the deposit with more level of confidence.

1.3 Objectives

1.3.1 Main objectives

Ore reserve estimation to ascertain the economic viability of the mine.

1.3.2 Specific objectives

(i) To carry out the geological interpretation.

(ii) To determine the block model.

(iii)To develop the 3D model for the deposit.

1.4 Justification

Surface mining at Kikagati is only directed to recovery of eluvial tin ore form a shallow depth, therefore the company's consideration to properly estimate the reserves putting concerns on the mineral inventory would make the mining more feasible. This will;

I. Improve on the mining efficiency like productivity, dilution control, ore losses and recovery.

II. Reduce operation cost like cost due to extracting grade inferior to cutoff grade.

III. It determines whether to abandon the project, invest in more detailed exploration or move to the next stage of the life of the mine to develop and prepare for mining.

IV. In the event of positive results from this estimate, the suitable mining method is obtained to extract the cassiterite at the lowest possible cost.

1.5 Significance of the study

The estimation of the reserve will help to determine the feasibility of the project, and with the level of confidence, it will determines whether to invest in more detailed exploration or abandon the mine.

In a case of positive results from the estimation of the reserves, it will help to select the best mining method for the deposit and this will reduce ore losses and dilution.

The estimation of the tin reserve will improve on productivity and efficiency of the mining operations and hence making the project more profitable.

1.6 Scope and limitation

It involves the designing the 3D model of the reserves.

Limited to ore reserve estimation of the tin deposit, the resource is presumed to be estimated by the company during their feasibility study and therefore, this study does no estimate the tine mineral resource. The cutoff grade is based on the current cutoff grade established by the company therefore there is no calculation of cutoff grade.

CHAPTER TWO: LITERATURE REVIEW

Introduction

This chapter deals with geological control of mineral inventory, continuity, statistical concept in mineral inventory, data and quality, exploration data evaluation, reserves estimation and tonnages curves

2.1 Some definitions

Mineralization: for the purpose of this document, means "material of interest. Mineral Resource and Mineral reserves are economic subset of such mineralization (43-101, n.d.)

Quality Assurance/Quality Con troll (QA/QC): For the purpose of this document, QA means "all of those planned or systematic actions necessary to provide adequate confidence in the data collection and estimation process" and QC means "the system and mechanisms put in place to provide the QA". (43-101, n.d.)

Mineral Resource: is a concentration or occurrence of natural, solid, inorganic, or fossilized organic material in or on the earth's crust in such form and quality and of such grade or quality that it has reasonable prospects for economic extraction. (43-101, n.d.)

Mineral Reserve is the economically mineable part of a measured part of a Measured or Indicated A mineral Reserve includes diluting materials and allowances for losses that may occur when the material in mined. (43-101, n.d.)

Estimate: for the purpose of this document means: "to approximate the value, worth, or the significance, to determine the size, extent, or nature of the deposit" (43-101, n.d.)

Preliminary Feasibility Study is a comprehensive study of the viability of a mineral project that has advanced to the stage where the mining method, in the case of underground mining ,or the open pit configuration, in the case of an open pit, has been established and which, if an effective method of mineral processing has been determined includes a financial analysis based on reasonable assumptions of technical, engineering, operating, and economic factors and evaluation of other relevant factors which (43-101, n.d.).

References

43-101, C. S. a. r. i. N., n.d. s.l.:s.n.

Anon., 2004. A FINAL REPORT OF GEOPHYSICAL, GEOLOGY AND DRILLING RESULTS OF SHEIKHALI ORE DEPOSITE. *GEOLOGICAL SURVEY OF IRAN,* p. 1381.

Anon., n.d. s.l.:s.n.

Erarslan, 2008. *Computer Aided Ore Body Modelling Mine Valuation.* Kutahya, Turkey: Dumlumpinar University, Mining Engineering Department..

Goodman and Co., 1995. *Evaluating Mineral Projects.* South Africa: Society for Mining, Metullargy, and Exploration, Inc, ISBN 0-87335-159-2.

Group de Reflexion, 2008. *Economic Evaluations in Exploration and mining.* New York: Springer, ISBN 978-540-73557-1.

H., MADANI, 1378. GEOSTATISTIC. In: s.l.:s.n.

Knudsen, H., 1975. *A Comparison of the Geostatistical Ore Reserve Estimation Method Over the Conventional Method.,* Arizon: Department of mining engineering University of Arizon..

Minerals Council Of Austrailia, September 1999. *Australasian Code for Reporting Of Identied Mineral Resources and Ore Reserves.* 4th Edition ed. Austrailia: Australian Institute of Geoscientists and Minerals Council Of Austrailia(JORC).

Sinclair, A. J., 2002. *Mineral Inventory Estimation.* The Waterfront, Cape Town 8001, South Africa: ISBN 0-511-03145-9 eBook.

Snowden, V., 2000. *Mineral Resource and ore Reserve Estimation,* West Perth WA 6872: Snowden Mining Industry Consultants Pty Ltd.

Wang, Y., 2006. *Determination of Uncertainty in Ore Reserves Estimation.,* s.l.: Southwest mining Instutite, China.

APPENDICES

Appendix 1: Exploration Data

SAMPLE PIT ID	Elevation(m)	O/B(thickness)	Ore(thickness)	Ore weight(g)	Raw weight(kg)