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ACCOUNTING THE MINERAL RESOURCES OF THE CORDILLERA REGION

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Aldrin Federico R. Bahit, Jr.², Jeannel I. Barcayan³ and Stephen Dale C. Estigoy⁴

ABSTRACT

This paper presents the accounting of the metallic and non-metallic mineral reserves in the Cordillera Administrative Region (CAR), specifically the asset accounts for gold and copper reserves and volumes of production of silver, sand and gravel, quicklime, slake lime and limestone following the United Nations System of Environmental-Economic Accounting (SEEA) 2012 Central Framework.

It presents the physical and monetary asset accounts for metallic mineral reserves covering a 13-year period from 2004 to 2016. In physical terms, the declared reserves of the large-scale mining companies were used as inputs to determine the stock of gold and copper reserves in ore form and metal content. For monetary accounts, the Net Present Value (NPV) approach was applied in the valuation using 12 percent and 15 percent discount rates.

In line with the SEEA framework, three classes of gold and copper were derived: Class A – minerals that were being mined; Class B – minerals that can be mined in the future with researches and exploration done; and Class C – minerals that have a probability to be mined where studies were conducted and a high level of confidence that it can be mined. The mineral reserves are estimated and presented in ore form and in metal content for all classes.

This paper will also present the estimated mine lives for both gold and copper reserves. As for silver and the other non-metallic minerals (sand and gravel, quicklime, slake lime and limestone), only their production value can be compiled. Tables are prepared for quantity and value of production.

INTRODUCTION

CAR Mineral Profile

The Mines and Geosciences Bureau (MGB) estimated that nine million hectares or 30.0% of the total land area of the Philippines have high mineral potential as of 2016. In the Cordillera Administrative Region (CAR), there were 11 approved Mineral Production Sharing Agreement (MPSA) in 2016 with total area of 15,542.9 hectares comprising 0.8% of the total land area of the region and 0.2% of the total mineable land in the country.

Based on the result of the 2016 Annual Survey of Philippine Business and Industry (ASPBI), the region employed 5,156 workers that was 17.8% of the total employment for Mining and Quarrying (MAQ). The number of employed in MAQ was third highest in the country. Davao

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region had the most with 5,887 workers or 20.3% of the total followed by Caraga with 5,804 workers or 20.0%. The region came fourth with the highest expenses including compensation with ₱13.8 billion or 15.1% the total national expenses for the industry.

Mining and quarrying industry contributed 2.9 percent to the total Gross Regional Domestic Product of CAR at current prices in 2016. The gross value added of mining and quarrying industry in CAR declined by an annual average growth of 2.3 percent from PHP9.4 billion in 2004 to PHP7.0 billion in 2016.

Table 1 shows the output of production of mineral resources and their value in 2016.

Table 1. Production and Value of Mineral Resources of CAR: 2016

Minerals	Production	Value (in PHP)
Metallic		
Gold	4,410.9 Kg	8.1 billion
Copper	73,109.0 MT	3.8 billion
Silver	4,394.4 Kg	112.0 million
Non-metallic		
Sand and Gravel	770,275.5 m ³	175.0 million
Quicklime	9,253.8 MT	78.0 million
Slake lime	3,201.8 MT	198.0 thousand
Limestone	5,008.2 MT	5.6 million

Source: MGB – CAR

OBJECTIVES OF THE STUDY

The general objective of the study is to support the institutionalization of environmental-economic accounting following the UN System of Environmental-Economic Accounting (SEEA) 2012, particularly in mineral resources accounting.

Specifically, the study intends to:

1. Come up with accounts of mineral reserves of CAR in gold and copper;
2. Value the gold and copper reserves of CAR;
3. Report the quantity and value of production of silver and non-metallic minerals; and
4. Come up with possible recommendations for the improvement of the accounting and valuation of mineral resources of CAR.

FRAMEWORK OF THE STUDY

Scope and coverage

The asset accounting for mineral resources involved the gathering of data from large-scale mining companies located and operating in the region. Physical and monetary accounts were done for gold and copper. As for silver, sand and gravel, and lime, only production values were compiled since there were no sufficient data to operationalize the SEEA 2012 – Central Framework.

The accounting spanned 13 years from 2004 to 2016. The study computed the physical stocks of gold and copper reserves in ore and metal content for the physical asset accounts. And the valuation of the metal contents of gold and copper comprised the monetary asset accounts.

Conceptual Framework

The asset accounts for mineral resources in physical and monetary terms adopted the SEEA 2012-Central Framework. The SEEA 2012-Central Framework is an international statistical standard for environmental-economic accounting adopted by the United Nations Statistical Commission. It is a multi-purpose conceptual framework for understanding the interactions between the economy and the environment, and for describing stocks and changes in stocks of environmental assets (UN 2014, vii). The basic structure of asset accounts for mineral resources is presented in Table 2.

Table 2. Basic Accounting Structure of Asset Accounts for Mineral Resources

Opening stock of mineral resources 1/	
Additions to stock 1/	
Discoveries	Estimates of the quantity of new deposits found during an accounting period.
Upward reappraisals	An increase due to changes in the categorization of specific deposits between class A, B or C based on changes in geologic information, technology, resource price or combination of these factors.
Reclassifications	May occur if certain deposits are opened or closed to mining operations owing to government decisions concerning the access rights to a deposit.
<i>Total additions to stock</i>	Aggregated estimates of discoveries, upward reappraisals and reclassifications
Reductions in stock 1/	
Extractions	Quantity of the resource physically removed from the deposit.
Catastrophic losses	Losses due to catastrophic or exceptional events like flooding and collapsing of mines.
Downward reappraisals	A decrease due to changes in the categorization of specific deposits between class A, B or C based on changes in geologic information, technology, resource price or combination of these factors.
Reclassifications	May occur if certain deposits are opened or closed to mining operations owing to government decisions concerning the access rights to a deposit.
<i>Total reductions in stock</i>	Aggregated estimates of extractions, catastrophic losses downward reappraisals and reclassifications
Revaluations 2/	
Closing stock of mineral resources 1/	

Note: 1/ In monetary asset accounts, measured in terms of value

2/ Applicable only in monetary asset accounts

Classification of mineral resources

The scope of known mineral deposits is defined using the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009) (United Nations, Economic Commission for Europe, 2010). The UNFC-2009 is a generic, flexible scheme for classifying and evaluating quantities of fossil energy and mineral resources (UN 2014, 161). The UNFC-2009 is based on a breakdown of the resources according to three criteria affecting their extraction:

Economic and social viability (E) – Designates the degree of favorability of economic and social conditions in establishing the commercial viability of the project;

Field Project status and feasibility (F) – Designates the maturity of studies and commitments necessary to implement mining plans or development of projects, extending from early exploration efforts occurring before it has been confirmed that a deposit or accumulation exists, to projects involving extraction and sale of a product; and

Geological knowledge (G) – Designates the level of certainty of geologic knowledge and of potential recoverability of quantities of the resource concerned.

Known deposits are categorized in three classes, each defined according to combinations of criteria derived from UNFC-2009:

Class A: Commercially recoverable resources;

Class B: Potentially commercially recoverable resources; and

Class C: Non-commercial and other known deposits.

OPERATIONAL FRAMEWORK

Data and data sources

The data utilized in the estimation of physical and monetary asset accounts for mineral resources were based on the accomplished administrative forms submitted by mining firms to MGB-CAR.

Physical asset accounts

1. *Declaration of Mining Project Feasibility (DMPF)*. The DMPF is a regulatory requirement for application by mining companies submitted to MGB prior to the start of mining operation. This includes the plans of a mining firm to undertake the operation requiring approval from the government. The DMPF and the attached documents are as follows:
 - Exploration Report — includes the profile of the mining company, including the name of company, address, and primary and secondary commodity produced.
 - Mining Project Feasibility Study (MPFS) — used to validate the data in the exploration report.

2. *Annual Mineral Resource/Reserve Inventory (AMRI) Report.* The relevant information available in AMRI includes: annual data on the remaining reserves; extraction or production; data related to reappraisals (i.e., changes in mineral grade and recovery rates); classification of reserves; status of mining operations; and date of submission to MGB by the mining companies.
3. *MGB Form 29-01 and 29-02.* These contain information on Monthly Report on Production, Sales, Inventory of Metallic Minerals for Gold (29-01) and Copper (29-02). Data on monthly milling recovery is generated from these reports.

Monetary asset accounts

Integrated Annual Report (IAR). The IAR, consolidated by the MGB, provides a disaggregated data on revenue income and other secondary income, detailed cost estimates of mining companies, etc.

Data limitations

The AMRI report is the primary source of data on mineral reserves. As to the completeness of entries, there were missing data in the IAR, AMRI and MGB Form 29-01 and 29-02. Some of these data were statistically imputed to complete the series. Other omitted data were verified using other generated reports of the bureau.

The minerals presented in these reports for complete accounting were focused on metallic minerals, specifically, gold and copper. Data on production of silver, lime, and sand and gravel were good for the preparation of tables on quantity and value of production.

Estimation methodology

Physical asset accounts

The physical asset account denotes the changes in opening and closing stocks of mineral resources in the region. Stocks increase due to discoveries, upward reappraisals and/or reclassifications. The decrease in stock of resources can be attributed to extraction, catastrophic losses, downward reappraisals and/or reclassifications.

Data on discoveries are not explicitly seen on AMRI report submitted by the mining firms to MGB-CAR. Also, data on reclassifications are not readily available. However, there are indicators that reflect the increase and decrease of the reserves. Reappraisals were used as the balancing item. All derived to be additions to stock of mineral resources are assumed to be upward reappraisals. Extractions are the main contributor to the reductions in stock, while other reductions are assumed to be downward reappraisals. Therefore, stocks increased due to the assumed upward reappraisals, while decreases in the stocks were mainly due to extractions. Other reductions were due to downward reappraisals.

The presented ore form in this study was based on the classification system by the Philippine Mineral Resource/Reserve Classification (PMRC). The PMRC was bridged with the UNFC classification system recommended by the SEEA 2012 Central Framework to align the two classification and to facilitate comparison. Positive mineral reserve is classified as Class A, probable mineral reserve is classified as Class B and possible mineral reserve is classified as Class C.

Monetary asset accounts

The monetary asset was estimated using the Net Present Value (NPV) approach. As defined in the SEEA 2012 – Central Framework, NPV is the value of an asset determined by estimating the stream of income expected to be earned in the future, and discounting the future income back to the present accounting period. The NPV approach requires to determine parameters such as *resource rent*, which is the surplus value taken to be the return to the asset itself; *resource or asset life*, which refers to the expected time over which an asset can be used in production or the expected time over which extraction from a natural resource can take place; and *discount rate* to convert the expected stream of resource rents into a current-period estimate of the overall value.

In the valuation of mineral reserves, only Class A in metal content was valued for its economic purpose. Companies with no report on gross output were imputed from the consolidated annual production output/value for the region.

RESULTS AND DISCUSSION

Physical Asset Accounts for Gold

In 2016, 296 thousand metric tons of gold ore were extracted yielding 40 thousand kilograms of metal content. The closing stock of Class A gold reserve on that period was estimated at 9.9 million metric tons and corresponding closing stock of 1.3 million kilograms in metal content. The level of ore increased to the estimated level in 2016 due to upward reappraisals and the general decline in extraction.

Table 3. Closing Stock of Class A Gold Reserve, Extraction and Mine Life, CAR: 2004-2016

Year	Extraction in Ore Form (in '000 MT)	Closing Stock in Ore Form (in '000 MT)	Extraction in Metal Content (in '000 kg)	Closing Stock in Metal Content (in '000 kg)	Mine Life (in Years)
2004	537.4	3,647.0	91.1	618.6	6
2005	459.6	4,088.0	86.1	765.8	8
2006	571.2	5,170.5	120.7	1,092.9	11
2007	586.2	5,049.4	122.8	1,058.2	11
2008	474.1	5,193.7	103.1	1,133.1	12
2009	389.3	2,684.2	81.8	564.8	6
2010	337.0	3,030.7	72.3	651.4	7
2011	529.2	9,128.1	106.9	1,848.4	19
2012	568.7	8,559.3	137.3	2,205.6	23
2013	745.3	8,344.4	186.6	2,092.4	21
2014	381.4	7,714.1	58.9	1,194.4	12
2015	349.8	5,558.1	60.3	964.3	10
2016	295.5	9,928.1	39.8	1,331.5	14

Source: PSA RSSO-CAR

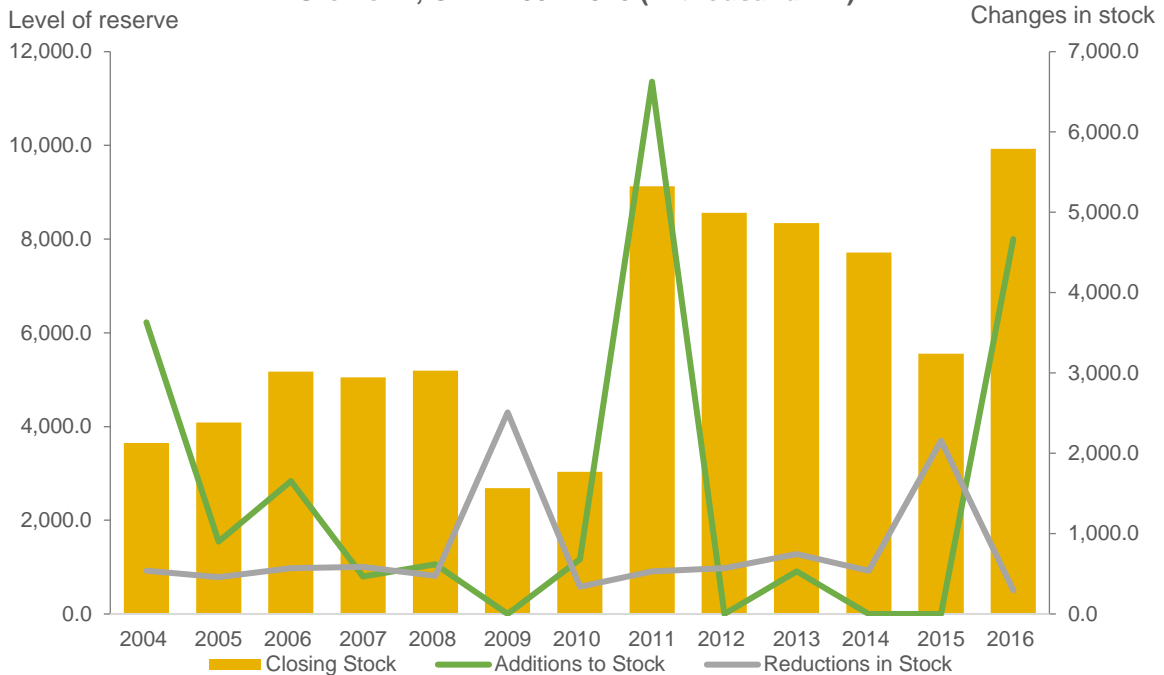
From 2004 to 2016, the 6.2 million metric tons of gold ore extracted yielded 1.3 million kilograms of gold metal content. This translated to an average ratio of 0.2 kilogram metal content

for every ton of ore extracted. As of 2016, it was estimated that it would take another 14 years for the gold reserve to be totally depleted.

Changes in stocks in ore form

The total reductions in stock in ore reserves across the years amounted to 10.3 million MT. In 2009, a total of 2.5 million MT of gold ore was deducted from the stocks, where 84.5% or 2.1 million MT was considered downward reappraisal. The remaining 15.5% constituted the level of extraction for the year. The lowest reduction in stock was recorded in 2016, while the biggest decline was reported between 2008 and 2009 which reflects 48.3% change in the closing stock.

Figure 1. Closing Stock and Changes in Stock of Class A, Gold Reserve, Ore Form, CAR: 2004-2016 (in thousand MT)



Source: PSA RSSO-CAR

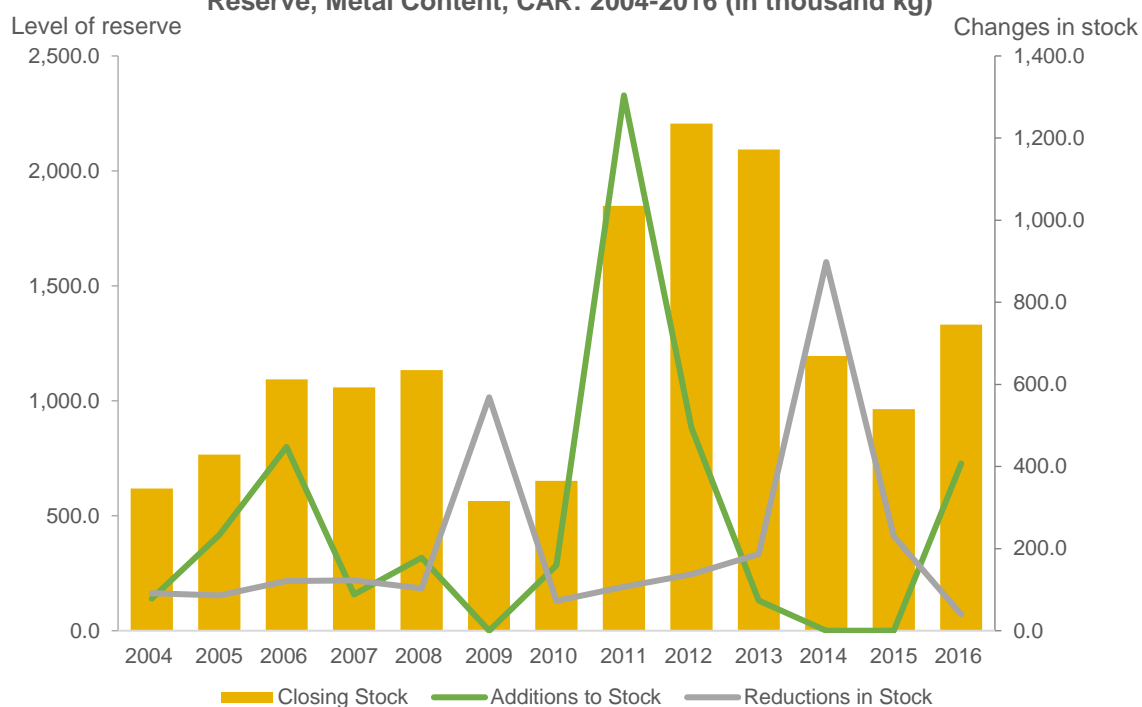
For the additions to stock, the highest increase was posted in 2011 with 6.6 million MT contributed by upward reappraisals. Aside from the low extraction in 2016, there was an increase of 4.7 million MT of gold ore reserve contributed by the high ending inventory. Additions were at the minimum in 2007 with 465,166 MT. The sum of all additions to stocks amounted to 19.8 million MT. There were no recorded additions for the years 2009, 2012, 2014 and 2015.

Changes in stocks in metal content

The biggest additions to stock, in terms of metal content, was recorded in 2011 with 1.3 million kilograms. The largest increase in the reserve also occurred in the same year with almost thrice the reserve of the previous year due to the high grade and milling recovery. The sum of all additions to stocks amounted to 3.5 million kilograms. There were no recorded additions for years 2009, 2014 and 2015.

The largest decrease was recorded in 2014 with 898,008 kilograms. A large quantity of metal content was also deducted in 2009 (568,325 kilograms). The total reductions in stock in metal content amounted to 2.8 million kilograms.

Figure 2. Closing Stock and Changes in Stock of Class A, Gold Reserve, Metal Content, CAR: 2004-2016 (in thousand kg)



Source: PSA RSSO-CAR

Closing stocks of Class B and C gold reserves

Closing stock of Class B gold ore as of 2016 was 5.6 million MT and highest was in 2010 with 9.8 million MT. The lowest of which was recorded in 2009 with 815,316 MT of ore. For Class C, the biggest ore reserve was reported in 2011 with 24.3 million MT of ores which remained until the closing stock of 2012.

Table 4. Summary Closing Stock of Class B and C Gold Reserve, Ore Form and Metal Content, CAR: 2004-2016

Year	Class B		Class C	
	Ore Form (in '000 MT)	Metal Content (in kg)	Ore Form (in '000 MT)	Metal Content (in kg)
2004	1,634.1	74.4	14,482.1	1,615.6
2005	1,630.9	73.6	21,116.1	1,767.9
2006	1,424.0	63.9	20,948.7	1,618.5
2007	1,538.2	63.5	16,941.2	1,147.5
2008	1,786.8	75.2	18,045.9	574.8
2009	815.3	38.2	18,703.7	660.7
2010	9,753.6	445.6	22,677.4	617.5
2011	9,344.8	421.0	24,288.3	659.8
2012	1,201.2	47.5	24,288.3	655.9
2013	1,545.9	56.4	15,588.3	449.6
2014	2,420.6	80.4	15,588.3	451.2
2015	5,207.3	133.9	288.8	14.0
2016	5,644.3	142.1	655.3	61.9

Source: PSA RSSO-CAR

Class B gold reserve in metal content was highest in 2010 with 445,554 kilograms. The lowest was recorded in 2009 with 38,179 kilograms. Class C, on the other hand, was reported to be highest in 2005 with 1.8 million kilograms. It decreased by 96.9% in 2015 with a total of 14,010 kilograms from 451,191 kilograms in 2014.

Monetary Asset Accounts for Gold

Two discounts rates were computed: 12% as the usual rate used internationally and 15% as prescribed by the NEDA Board.

At 12% discount rate, gold reserve in metal content was valued at ₱14.3 billion as of closing stock of 2016. While at 15% discount rate, closing stock was valued at ₱12.3 billion.

Table 5. Monetary Valuation* of Closing Stock, Class A Gold Reserve, CAR: 2004-2016

Year	Closing Stock in Metal Content		
	Level (in '000 kg)	Valuation at 12% (in '000 PHP)	Valuation at 15% (in '000 PHP)
2004	618.6	4,768,988.5	4,389,775.4
2005	765.8	6,467,534.5	5,842,192.3
2006	1,092.9	16,378,614.8	14,436,728.5
2007	1,058.2	21,267,506.0	18,745,981.5
2008	1,133.1	22,271,262.1	19,489,301.5
2009	564.8	13,436,292.0	12,367,885.4
2010	651.4	22,665,323.2	20,662,201.6
2011	1,848.4	45,091,460.3	37,944,035.1
2012	2,205.6	25,837,152.5	21,419,855.1
2013	2,092.4	25,391,499.4	21,195,822.5
2014	1,194.4	18,226,806.2	15,950,048.9
2015	964.3	19,401,517.6	17,233,253.9
2016	1,331.5	14,290,379.7	12,342,011.7

*At Net Present Value
Source: PSA RSSO-CAR

Physical Asset Accounts for Copper

In 2016, 9.3 million metric tons of copper ore were extracted yielding 1.7 million metric tons of metal content. The closing stock of Class A copper ore reserve on that period was estimated at 59.7 million metric tons and corresponding closing stock of 10.6 million metric tons in metal content.

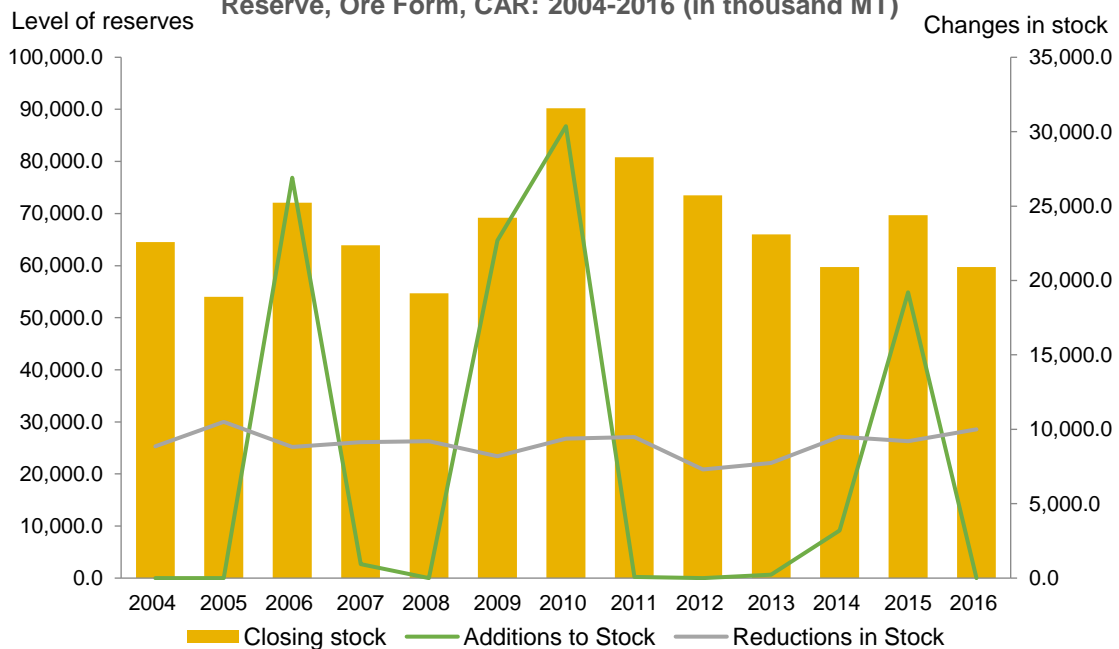
Table 6. Closing Stock of Class A Copper Reserve, Extraction and Mine Life, CAR: 2004-2016

Year	Extraction in Ore Form (in '000 MT)	Closing Stock in Ore Form (in '000 MT)	Extraction in Metal Content (in '000 MT)	Closing Stock in Metal Content (in '000 MT)	Mine Life (in years)
2004	8,846.9	64,500.0	1,589.8	11,590.6	7
2005	8,639.2	54,000.0	1,629.0	10,181.9	6
2006	8,804.4	72,100.0	1,831.9	15,001.7	9
2007	9,131.9	63,900.0	2,128.1	14,891.4	9
2008	8,973.5	54,700.0	1,782.7	10,866.7	6
2009	8,183.7	69,200.0	1,727.7	14,609.3	9
2010	9,368.9	90,200.0	1,888.6	18,182.4	11
2011	9,477.6	80,800.0	1,675.2	14,281.5	9
2012	5,607.9	73,500.0	1,026.9	13,458.9	8
2013	7,729.9	66,000.0	1,398.9	11,943.7	7
2014	9,504.9	59,700.0	1,739.1	10,922.9	7
2015	9,195.3	69,700.0	1,668.0	12,643.7	8
2016	9,341.7	59,700.0	1,665.6	10,644.3	6

Source: PSA RSSO-CAR

From 2004 to 2016, the total 112.8 million MT of copper ore extracted yielded 21.8 million MT of copper metal content. This denoted an average ratio of 0.2 metric ton of copper metal content for every ton of copper ore. As of 2016, it was estimated that it would take another 6 years for the copper ore reserves to be totally depleted

Figure 3. Closing Stock and Changes in Stock of Class A, Copper Reserve, Ore Form, CAR: 2004-2016 (in thousand MT)



Source: PSA RSSO-CAR

The highest additions to stocks was in 2010 with additional 21.0 million MT. There were no recorded additions to stock for the years 2004, 2005, 2008, 2012 and 2016. The lowest addition to the stock occurred in 2011 with 77,575.0 MT contributed by upward reappraisals.

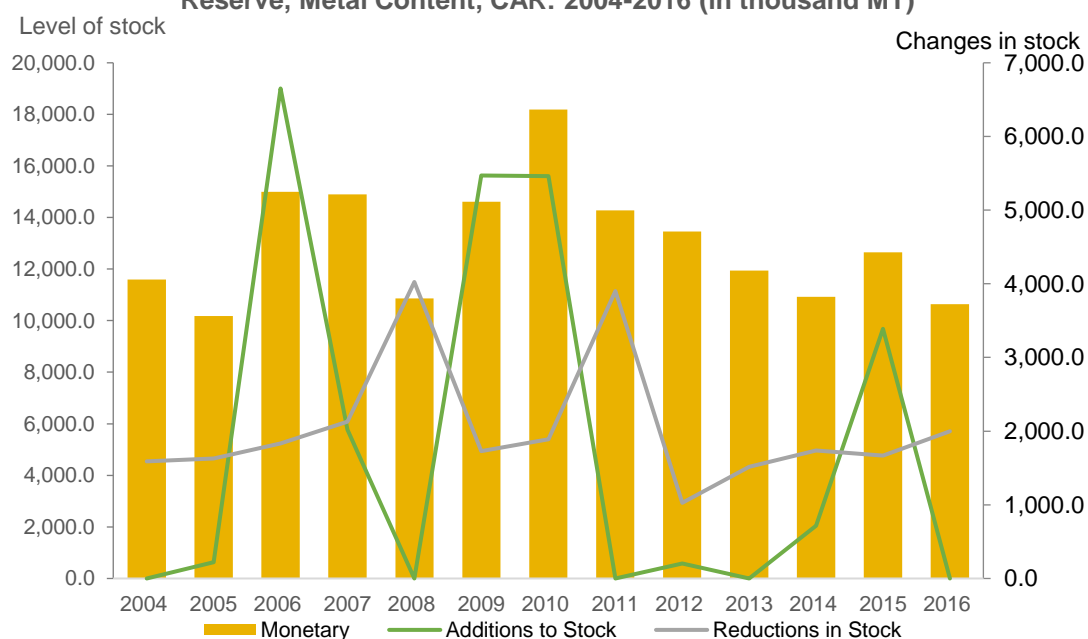
The total reductions in stock of copper ore reserves across the years accumulated to 117.2 million MT. The biggest reduction in stock was recorded in 2005 with 10.5 million MT. The smallest incurred reduction was observed in 2012 with 7.3 million MT.

Changes in stocks in metal content

In metal content, 6.7 million MT was added in 2006 due to upward reappraisal corresponding to a 47.3% increase. The least incurred addition to the reserve was in 2012 with 204,267 MT (Figure 4).

Reduction, on the other hand, was at the highest in 2008 at 4.0 million MT. It posted the minimum in 2012 at 1.0 million MT. The total estimated reductions amounted to 26.7 million MT with an average of 2.1 million MT from 2004 to 2016.

Figure 4. Closing Stock and Changes in Stock of Class A, Copper Reserve, Metal Content, CAR: 2004-2016 (in thousand MT)



Source: PSA RSSO-CAR

Closing stocks of Class B and C copper reserves

For the span of 13 years, the stocks of Classes B and C copper ore stayed the same with 63.0 million MT and 123.0 million MT, respectively (Table 8).

The annual average increase of copper reserve in metal content both for Classes B and C exhibited a minimal effect at 0.1 percent. The changes in the reserve over the years were due to the declared ore grade and milling recovery.

Table 7. Summary Closing Stock of Class B and C Copper Reserve, Ore Form and Metal Content, CAR: 2004-2016 (in thousand MT)

Year	Class B		Class C	
	Ore Form (in '000 MT)	Metal Content (in '000 MT)	Ore Form (in '000 MT)	Metal Content (in '000 MT)
2004	63,000.0	12,350.3	122,978.1	56,252.3
2005	63,000.0	12,029.2	122,978.1	54,790.0
2006	63,000.0	12,289.0	122,978.1	55,973.4
2007	63,000.0	12,766.7	122,978.1	58,149.0
2008	63,000.0	12,361.1	122,978.1	56,301.7
2009	63,000.0	12,382.0	122,978.1	56,396.9
2010	63,000.0	12,409.9	122,978.1	56,523.8
2011	63,000.0	12,430.2	122,978.1	56,616.2
2012	63,000.0	12,360.2	122,978.1	56,297.7
2013	63,000.0	12,160.9	122,978.1	55,389.6
2014	63,000.0	12,075.1	122,978.1	54,998.9
2015	63,000.0	12,410.9	122,978.1	56,528.4
2016	63,000.0	12,423.2	122,978.1	56,584.6

Source: PSA RSSO-CAR

Monetary Asset Accounts for Copper

At 12% discount rate, Class A copper reserve in metal content was valued at ₱5.0 billion as of closing stock of 2016. While at 15% discount rate, closing stock was valued at ₱4.6 billion.

Table 8. Monetary Valuation* of Closing Stock, Class A Copper Reserve, Extraction, CAR: 2004-2016

Year	Closing Stock in Metal Content		
	Level (in '000 MT)	Valuation at 12% (in '000 PHP)	Valuation at 15% (in '000 PHP)
2004	11,590.6	1,073,070.8	978,234.7
2005	10,181.9	6,152,069.5	5,662,878.6
2006	15,001.7	23,927,932.9	21,428,075.7
2007	14,891.4	25,210,110.1	22,576,298.2
2008	10,866.7	11,238,558.7	10,344,908.1
2009	14,609.3	11,177,225.9	10,009,491.6
2010	18,182.4	22,688,344.9	19,998,362.5
2011	14,281.5	21,312,549.4	19,085,932.9
2012	13,458.9	10,229,374.8	9,240,302.3
2013	11,943.7	10,010,702.9	9,125,974.5
2014	10,922.9	8,850,267.6	8,068,096.4
2015	12,643.7	9,650,564.6	8,717,457.0
2016	10,644.3	4,976,831.1	4,581,091.0

*At Net Present Value

Source: PSA RSSO-CAR

Production of silver and other non-metallic minerals

Due to data limitations, the accounting for silver and other non-metallic minerals (sand and gravel, quicklime, slake lime and limestone) were only good for the compilation of quantities and values production.

Table 9. Silver Production, CAR: 2004-2016

Year	Quantity (kg)	Value (PHP)
2004	7,185.0	83,052,194.0
2005	4,978.0	194,369,365.0
2006	5,096.0	92,476,807.0
2007	6,716.0	129,799,325.0
2008	9,889.8	171,129,097.3
2009	5,219.4	118,090,896.0
2010	5,376.0	160,774,209.8
2011	5,181.4	246,041,663.0
2012	3,680.3	97,288,217.0
2013	5,051.3	157,968,022.3
2014	4,564.7	122,603,992.1
2015	4,845.5	104,789,162.1
2016	4,394.4	118,923,247.2

Source of raw data: MGB-CAR

Table 10. Sand and Gravel Production, CAR: 2004-2016

Year	Quantity (m ³)	Value (PHP)
2004	152,773.0	27,160,156.0
2005	115,930.9	29,938,906.0
2006	134,579.9	33,336,918.8
2007	213,694.3	36,781,719.1
2008	161,767.5	28,192,090.7
2009	293,814.8	35,224,697.4
2010	243,646.7	40,157,522.4
2011	372,085.0	41,851,729.0
2012	545,179.2	41,228,199.5
2013	454,525.0	36,007,118.4
2014	756,886.9	139,364,578.4
2015	903,154.6	152,621,915.3
2016	770,275.5	163,621,606.9

Source of raw data: MGB-CAR

Table 11. Quicklime, Slake Lime & Limestone Production, CAR: 2004-2016

Year	Quicklime		Slake lime		Limestone	
	Quantity (MT)	Value (PHP)	Quantity (MT)	Value (PHP)	Quantity (MT)	Value (PHP)
2004	7,734.4	36,805,941.3	265.2	919,156.7	2,784.1	182,688.7
2005	6,229.8	27,374,138.1	277.4	1,064,936.5	766.9	43,223.5
2006	7,327.0	37,462,951.0	257.5	1,319,286.1	1,649.0	144,047.7
2007	7,824.0	42,392,888.0	273.7	1,405,908.7	532.7	63,106.5
2008	9,347.4	64,715,772.5	205.1	1,230,584.5	18,346.4	34,437.5
2009	7,375.4	49,415,233.6	312.0	1,708,090.8	15,448.8	12,359,048.0
2010	7,422.4	50,001,827.1	312.4	1,710,280.5	14,358.5	11,486,808.0
2011	8,171.3	55,102,046.2	383.1	2,097,176.8	15,030.8	12,024,600.0
2012	8,678.8	58,147,946.6	461.1	2,524,520.0	18,609.0	14,887,192.0
2013	9,070.1	60,770,125.0	33.1	181,420.1	20,476.3	16,381,024.0
2014	9,770.3	65,461,049.4	123.8	677,646.2	16,599.6	18,259,598.5
2015	7,848.1	59,069,664.5	53.5	327,575.1	16,599.6	18,578,832.4
2016	9,253.8	76,744,197.9	35.9	205,213.2	5,008.2	5,618,827.2

Source of raw data: MGB-CAR

IMPACTS/OUTCOMES & RECOMMENDATIONS

The following are the impacts/outcomes and notable takeaways from the compilation of asset accounts for mineral resources including the recommendations:

Hands-on learning on mining operations. As part of the orientation on the mining industry, the conducted trainings and site visits provided first-hand information that better visualize the accounting of mineral resources. The hands-on learning on the operations of the mining industry including their corporate social responsibilities provided the visual and tangible backdrop for the estimation process. The learnings and experiences gained will form part of the continuing effort of PSA CAR in developing the asset accounts and exploring other accounts, e.g. flow and activity-purpose accounts. It is recommended that PSA should keep abreast on the developments of the mining industry and thru MGB, establish a stronger linkage with the mining companies and other stakeholders of the mining industry.

Administrative reporting forms better utilized. The uses of MGB administrative forms were further realized as they provide relevant information for the estimation of the physical and monetary mineral asset accounts. These reports were better utilized with their contribution to this study. MGB-CAR was prompted to a more in-depth review and validate entries of the accomplished forms submitted by the mining and quarrying firms. This presses the companies to be more conscious on their reporting. It is recommended that the MGB prioritize the creation of databank/database of the information culled from administrative reports submitted to them by the mining companies. Furthermore, MGB could review their administrative forms for possible improvement on contents as well as the reporting system.

Defining terms and setting standards. Terms used in this study were conceptually and operationally defined for better understanding. Mine/asset life for example was defined by the MGB as the same as the 25-year mineral agreements with mining companies. Mine life then diminishes as the years pass by. SEEA on the other hand defined mine life as the years before the stock of mineral resource be exhausted which was operationally defined as the closing stock divided by the average extraction. Both definitions were better understood and for what purposes

they are used. This study follows the operational definition and standards of the SEEA 2012 Central Framework.

As a recommendation, standardization of local terms and definitions in accordance to international standards should be done to ensure comparability, i.e., adoption of United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC) by the mining industry. The mining industry in the country is currently using the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) as basis for reporting and classification.

Discussion on small-scale mining. The mineral accounting project also provided a venue for productive discourses on issues besetting the mining industry in the region. The more in-depth discussions were not just limited to issues on minerals data but also emphasized the issue on small-scale mining. The need for statistics on small-scale mining activities was brought to the surface and with that, churned a flurry of ideas and proposals on how to include them in the mineral accounting of the region. And so, PSA should continue to look for ways on how to include the small-scale miners into the mineral resources accounting of the Cordillera region.

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