

Interfacing JavaScript Program with Datamine for Block Model Regularisation – A Case Study*

¹D. Mireku-Gyimah and ¹S. K. Takyi
¹University of Mines and Technology (UMaT), Tarkwa

Mireku-Gyimah, D., and Takyi, S. K. (2017), “Interfacing JavaScript Program with Datamine for Block Model Regularisation – A Case Study”, *Ghana Journal of Technology*, Vol. 2, No. 1, pp. 61 - 68.

Abstract

Abosso Goldfields Limited (AGL) uses Datamine for block geolical modelling, Whittle Four-X for pit optimisation, Datamine and Geovia Surpac for pit designs and Runge XPAC and Talpac for production scheduling. To facilitate pit optimisation and production scheduling, there is the need to regularise the input block model, which means converting a block model with variable or fixed unit block size into another block model with uniform unit blocks of preferred size and assigning attributes such as grade and tonnage to the resulting unit blocks. Unfortunately, Datamine and Geovia Surpac software are unable to accurately regularise a block model to generate the input data for pit optimisation and production scheduling. This research aimed to develop a computer program, RegPlus, using JavaScript language and interface it with Datamine to perform block model regularisation. To assess the accuracy and reliability of the grade and tonnage in the regularised block model, the Tomento North Pit 1 block model of AGL was regularised using Datamine, Geovia Surpac and RegPlus. Ten different sets of unit block sizes were randomly selected to effect the block model regularisation using each of these three software. The total grade and tonnage in each of the ten (10) sets of regularised block models from each of the three software were compared with the total grade and tonnage in the original block model. The results revealed that irrespective of the unit block sizes selected for the block model regularisation, the total tonnage and grade in the regularised block model from RegPlus was 100 percent accurate when compared to the total tonnage and grade of the original block model. As expected, Datamine and Geovia Surpac could not give accurate results. RegPlus is thus a reliable tool to solve the problem of block model regularisation at AGL or any mine with the same problem.

Keywords: Block Model Regularisation, Pit Optimisation, Production Scheduling

1 Introduction

A geological block model is represented by a tightly packed collection of six sided orthogonal unit blocks (see Fig. 1) which help to visualise and understand a deposit (Barber, 2001). The attributes of each unit block such as grade and tonnage can be estimated from drill hole information using various mineral resource/reserve estimation methods. Then from the grade and tonnage of the unit blocks, the grade and tonnage of the deposit can be estimated. Mineral resource/reserve estimation methods are discussed by various authors including David (1977), Davis (1986) and Noble (1992).

The object of this paper is block model regularisation, which is the conversion of a block model with variable or fixed unit block sizes into another block model with regular unit blocks of preferred size and assigning the attributes of interest such as grade and tonnage to the regular unit blocks. This is not a process to create a new geological block model from drill-hole data where complex grade and tonnage estimation methods are required, but a process to reconfigure an existing geological block model into another block model with regular unit blocks of any preferred size and correctly assigning the attributes of interest to the unit blocks to facilitate mine planning, reporting and reconciliation.

Abosso Goldfields Limited (AGL) employs different software for each phase of its mine design and planning (i.e. from block modelling to production scheduling). The Geology Department uses Datamine software to do geological block modelling using drill-hole data. The unit blocks in the resulting block model have variable or fixed dimensions that define the orebody including its contacts. The block model serves as the input data for pit optimisation and design. The Mine Planning Department employs Whittle for pit optimisation; Geovia Surpac and Datamine for pit and waste dump designs; and Runge XPAC for production scheduling.

However, the Whittle and Runge XPAC only work with input data from regularised block models with feasible unit block dimensions to function properly and reduce run-time. Therefore whenever the task of pit optimisation or production scheduling is to be performed, the block model needs to be regularised.

The problem of block model regularisation is appreciated at AGL where the applied software (Geovia Surpac and Datamine) are not able to achieve this perfectly due to some limitations and therefore subsequent mine planning tasks become laborious and time consuming.

The limitation of using Datamine software for block model regularisation arises because the

assignment of attributes to the regularised unit blocks using Datamine is solely by averaging, which affects the data manipulation process. The result is a regularised block model with erroneous attributes, affecting data integrity and reliability.

The limitations of using Geovia Surpac for block model regularisation also arise because Geovia Surpac can only regularise a block model into another block model with unit block sizes which are integer multiples of the parent unit block sizes. This narrows the options available to select a preferred unit block size necessary for the mine planning task. Also, Geovia Surpac is unable to regularise a block model with variable unit block sizes (i.e. free block models).

This research aimed to develop a computer program (RegPlus) using JavaScript language and interface it with Datamine to perform block model regularisation. It was postulated that if the total tonnage and grade in the regularised block model are the same as those in the original block model, then RegPlus is a reliable program.

2 Resources and Methods Used

2.1 Resources

Tomento North Pit 1 block model (a proportional block model) used in this work was developed by the Geology Department of AGL using Datamine software. Blk5 block model (a centroid block model) was also developed using Datamine software for the purpose of testing the RegPlus software.

Datamine, Geovia Surpac and RegPlus software were used to regularise the Tomento North Pit 1 block model so that the results could be compared.

2.2 Methods

JavaScript language was integrated with Datamine to develop the RegPlus program for block model regularisation. JavaScripting and integration with Datamine constitute a discipline that cannot be covered in the space of this paper. However, a good idea about the discipline and its processes are provided by Anon. (2011), Anon. (2013a), Anon. (2013b), Anon. (2013c), Anon. (2013d) and Hack (2003).

The following assumptions were made in developing the RegPlus program:

- (i) Each unit block or cell within the block model structure has a centroid (with coordinates XC, YC and ZC) as shown in Fig. 1, which contains the attributes such as grade (Au),

density (SG) and resource classification code (RCODE).

- (ii) Each unit block or cell as shown in Fig. 1 is characterised by dimensions (XINC, YINC and ZINC) which define the volume of the block by Equation 1:

$$\text{Volume of Block} = XINC \times YINC \times ZINC \quad (1)$$

- (iii) The attributes are assumed to be uniform or homogeneous within each unit block of the geological block model and hence a piece or part of the unit block can be assigned the same attributes as the parent unit block.

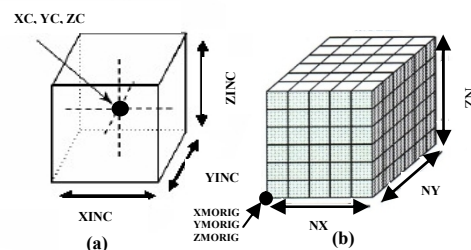


Fig. 1 Unit Block (a) and Block Model (b)

To demonstrate how these assumptions were applied to regularise a block model, a section through a typical block model with unit blocks of variable dimensions as shown in Fig. 2 is considered. When a regularised block model prototype with unit blocks of uniform dimension (Fig 3) is superimposed on the typical block model with the same origin, the result is what is shown in Fig. 4.



Fig. 2 A Section showing Block Model Unit Blocks

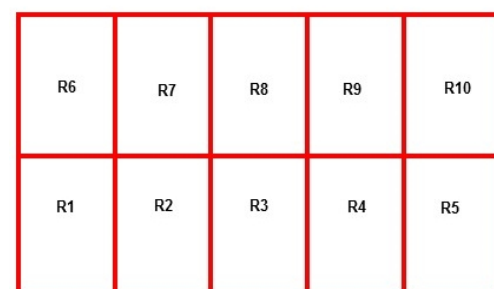


Fig. 3 Regularised Block Model Prototype (B)

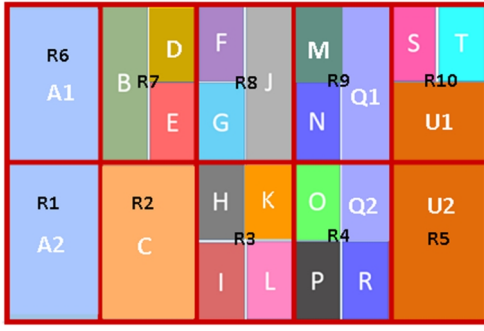


Fig. 4 Regularised Block Model Superimposed on Original Model

Each unit block in the typical block model (A, B, C..., U) has a unique code and unique set of attributes. Let the grade attribute (Au) of the unit blocks (A, B, C, ..., U) be denoted by $Au_A, Au_B, Au_C, \dots, Au_U$ and the density attribute (SG) be denoted by $SG_A, SG_B, SG_C, \dots, SG_U$ respectively.

The total tonnage of the block model before the regularisation process is given by:

$$t(\text{total}) = \sum_{i=A}^U (XINC_i * YINC_i * ZINC_i * SG_i) \quad (2)$$

where i is the unique codes of the unit blocks.

The total metal in grams contained in the block model before regularisation is given by Equation 3:

$$m(\text{total}) = \sum_{i=A}^U (t_i * Au_i) \quad (3)$$

where t_i is the tonnage of a unit block.

Hence, the average grade is calculated as the sum of the metals of all the unit blocks divided by the total tonnage of all the unit blocks. This is given as:

$$\text{Average grade (Au)} = \frac{m(\text{total})}{t(\text{total})} \quad (4)$$

The tonnage (t) and average grade (Au) of the regularised unit block R1 are:

$$\begin{aligned} \text{Tonnage of R1 } (t_{R1}) &= t_{A2} \\ \text{Grade of R1 } (Au_{R1}) &= Au_{A2} \end{aligned}$$

The tonnage (t) and average grade (Au) of the regularised unit block R2 are:

$$\begin{aligned} \text{Tonnage of R2 } (t_{R2}) &= t_C \\ \text{Grade of R2 } (Au_{R2}) &= Au_C \end{aligned}$$

The tonnage (t) and average grade (Au) of the regularised unit block R3 can be calculated as:

$$\begin{aligned} \text{Tonnage of R3 } (t_{R3}) &= (t_H + t_I + t_K + t_L) \\ \text{Metal Content of R3 } (m_{R3}) &= (t_H * Au_H + t_I * Au_I + t_K * Au_K + t_L * Au_L) \end{aligned}$$

$$\text{Average grade of R3 } (Au_{R3}) = \frac{m_{R3}}{t_{R3}}$$

The tonnage (t) and average grade (Au) of the regularised unit block R4 can be calculated as:

$$\begin{aligned} \text{Tonnage of R4 } (t_{R4}) &= (t_O + t_P + t_R + t_{Q2}) \\ \text{Metal Content of R4 } (m_{R4}) &= (t_O * Au_O + t_P * Au_P + t_R * Au_R + t_{Q2} * Au_{Q2}) \\ \text{Average grade of R4 } (Au_{R4}) &= \frac{m_{R4}}{t_{R4}} \end{aligned}$$

The tonnage (t) and average grade (Au) of the regularised unit block R5 are:

$$\begin{aligned} \text{Tonnage of R5 } (t_{R5}) &= t_{U2} \\ \text{Grade of R5 } (Au_{R5}) &= Au_{U2} \end{aligned}$$

The tonnage (t) and average grade (Au) of the regularised unit block R6 are:

$$\begin{aligned} \text{Tonnage of R6 } (t_{R6}) &= t_{A1} \\ \text{Grade of R6 } (Au_{R6}) &= Au_{A1} \end{aligned}$$

The tonnage (t) and average grade (Au) of the regularised unit block R7 can be calculated as:

$$\begin{aligned} \text{Tonnage of R7 } (t_{R7}) &= (t_B + t_D + t_E) \\ \text{Metal Content of R7 } (m_{R7}) &= (t_B * Au_B + t_D * Au_D + t_E * Au_E) \\ \text{Average grade of R7 } (Au_{R7}) &= \frac{m_{R7}}{t_{R7}} \end{aligned}$$

The tonnage (t) and average grade (Au) of the regularised unit block R8 can be calculated as:

$$\begin{aligned} \text{Tonnage of R8 } (t_{R8}) &= (t_F + t_G + t_J) \\ \text{Metal Content of R8 } (m_{R8}) &= (t_F * Au_F + t_G * Au_G + t_J * Au_J) \\ \text{Average grade of R8 } (Au_{R8}) &= \frac{m_{R8}}{t_{R8}} \end{aligned}$$

The tonnage (t) and average grade (Au) of the regularised unit block R9 can be calculated as:

$$\begin{aligned} \text{Tonnage of R9 } (t_{R9}) &= (t_M + t_N + t_{Q1}) \\ \text{Metal Content of R9 } (m_{R9}) &= (t_M * Au_M + t_N * Au_N + t_{Q1} * Au_{Q1}) \\ \text{Average grade of R9 } (Au_{R9}) &= \frac{m_{R9}}{t_{R9}} \end{aligned}$$

The tonnage (t) and average grade (Au) of the regularised unit block R10 can be calculated as:

$$\begin{aligned} \text{Tonnage of R10 } (t_{R10}) &= (t_S + t_T + t_{U1}) \\ \text{Metal Content of R10 } (m_{R10}) &= (t_S * Au_S + t_T * Au_T + t_{U1} * Au_U) \\ \text{Average grade of R10 } (Au_{R10}) &= \frac{m_{R10}}{t_{R10}} \end{aligned}$$

At the end of the block model regularisation process, the sum of the tonnages of all the regularised unit blocks must be equal to the sum of the tonnages of all the unit blocks of the original block model. Similarly, the weighted average grade of the regularised block model must be equal to the weighted average grade of the original block model.

These assumptions were the main drivers considered in the development of the RegPlus program. Fig. 5 shows the process flow chart for the block model regularisation using RegPlus program. The complete RegPlus program code is too lengthy to present in this paper so only a small part of it is shown in Fig. 6. Microsoft Office SharePoint Designer, which uses JavaScript language, was used to design the Front Page of the RegPlus program shown in Fig. 7.

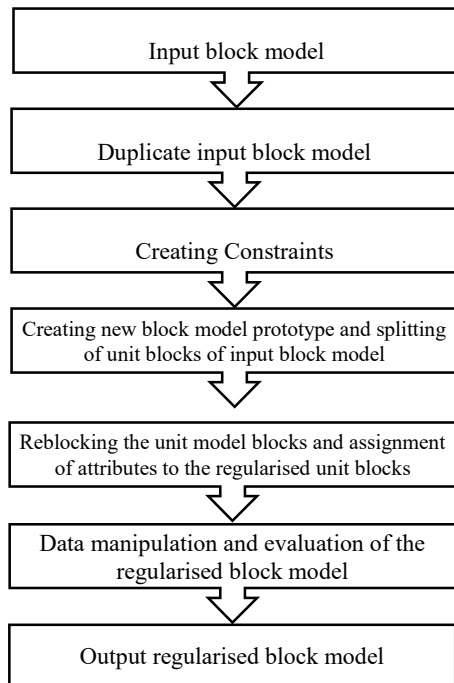


Fig. 5 Process Flow Chart of RegPlus

```

-----
CREATING A NEW REGULARIZED BLOCK MODEL
-----
oDmApp.ParseCommand ("extra &IN=xout3 &OUT=xout5 @APPROX=0
@PRINT=0"+
" 'XINC="+nxin+" ' "+
" 'YINC="+nyin+" ' "+
" 'ZINC="+nzin+" ' "+
" 'XC=int ( (XC-"ymor+"/YINC)*XINC+"xmor"+XINC/2' "+
" 'YC=int ( (YC-"ymor+"/YINC)*YINC+"ymor"+YINC/2' "+
" 'ZC=int ( (ZC-"zmor+"/YZNC)*ZINC+"zmor"+ZINC/2' "+
" 'GO' ");

oDmApp.ParseCommand ("mgsort &IN=xout5 &OUT=xout5 *KEY1=LJK
@ORDER=1");
oDmApp.ParseCommand ("acmilt &IN=xout6 &OUT=xout7 *KEY1=XC
*KEY2=YC *KEY3=ZC @ALLRECS=0
@UNSORTED=1");
oDmApp.ParseCommand ("filcom &IN=xout7 &OUT=xout8");
oDmApp.ParseCommand ("seldel &IN=xout8 &OUT=xout9 *F1=LJK *
F2=RESCAT *F3=AU *F4="+dens+" *
F5=XINC *F6=YINC *F7=ZINC
@KEEPALL=0");
oDmApp.ParseCommand ("ijkgen &PROTO=protto &IN=xout9
&OUT=xout10 *X=XC *Y=YC *Z=ZC
@PSMODEL=0");
oDmApp.ParseCommand ("extra &IN=xout10 &OUT=xout10 @APPROX=0
@PRINT=0"+
" 'XINC="+nxin+" ' "+
" 'YINC="+nyin+" ' "+
" 'ZINC="+nzin+" ' "+
" ' "+dens+"=TON/VOL' "+
" 'OTON=TF1+TM1+TF2+TM2+TF3+TM3' "+
" 'MET=MF1+MM1+MF2+MM2+MF3+MM3' "+
" 'AU=MET/OTON' "+
" 'IF (AU=absent () ) AU=0 END' "+
" 'ROCK=1 ' "+
" 'GO' ");

oDmApp.ParseCommand ("filcom &IN=xout11 &OUT=xout11");
oDmApp.ParseCommand ("mgsort &IN=xout11 &OUT="+outmode+" *
KEY1=LJK @ORDER=1");
oDmApp.ParseCommand ("acmilt &IN="+outmode+" &OUT=xout12 *
KEY1=ROCK @ALLRECS=0 @UNSORTED=1");
  
```

Fig. 6 Part of RegPlus Program Code

BLOCK MODEL REGULARISATION SCRIPT
(RegPlus)
DEVELOPED BY SAMUEL KWESI TAKYI
(MPHIL. MINING ENGINEERING)

Model Information

Browse Input Model

Enter Output Model Filename

Enter Density Attribute Name

Enter Resource Class Code

Is it a Partial Model? Y/N

Constraint Information

Browse for Topo. DTM

Browse for Pit Design

Browse for Boundary String

Enter Minimum Elevation

Enter Maximum Elevation

Cut-off Grade Information

Enter Low-Grade Cut-off

Enter High-Grade Cut-off

Regularised Block Dimension Information

Enter New Block Size X

Enter New Block Size Y

Enter New Block Size Z

Fig. 7 The Front Page of the RegPlus Program

3 Results and Discussion

3.1 RegPlus Validation Results

RegPlus was validated with the Blk5 block model (centroid model) to see if it can perform block model regularisation properly without any syntax error and also produce total tonnage, grade and stripping ratio from the regularised block model that are the same as those from the original block model. The Blk5 block model has the following attributes:

- (i) Grade attribute: AU
- (ii) Density attribute: DENSITY
- (iii) Resource classification attribute: RCODE

Five different scenarios (Sc1 to Sc5) were considered to regularise the Blk5 block model by varying the unit block dimensions. The accuracy and validity of the tonnage and grade in each of the five (5) different regularised block models were assessed by comparing the results with the total tonnage and grade of the original block model at 0.7 g/t cut-off grade. Table 1 shows the tonnage and grade in each of the five (5) regularised block models and those in the original Blk 5 block model. It can be seen that the evaluation reports of each of the scenarios considered for the regularisation of the Blk5 block model produced the same results as those of the evaluation report of the original block model in terms of total tonnage, grade and total material contained within the constrained model. The test results show that irrespective of the unit block dimensions selected for the regularisation exercise, the resultant total tonnage and grade are the same as those of the original block model. The RegPlus program is therefore proven to be capable of completely dealing with all the issues with block model regularisation.

3.2 Results of Regularisation using Geovia Surpac and Datamine RegPlus

Having tested the capability of the RegPlus programme to regularise the centroid block model,

Blk5, the Tomento North Pit 1 resource block model (proportional model) was regularised for 10 different randomly selected unit block dimensions using Geovia Surpac, Datamine and the RegPlus program. The total grade and tonnage in each of the 10 sets of regularised block models from each of the three software were compared with the total grade and tonnage of the blocks in the original block model. The evaluation reports are shown in Tables 2, 3 and 4 respectively.

Table 2 reveals that whenever the regularised unit block dimensions were not integer multiples of the parent unit block dimensions, Geovia Surpac was not able to perform the regularisation function on the block model. However, Geovia Surpac is able to perform the block model regularisation function perfectly with accurate results where the regularised unit block dimensions are integer multiples of the parent unit block dimensions such as in Sc2 and Sc9.

From Table 3, it can be seen that Datamine Software allowed for block model regularisation for all unit block dimensions of choice except that the resultant evaluation reports do not reconcile exactly with the original block model evaluation report. The table also reveals huge percentage variance in terms of tonnage and grade as the regularised unit block dimensions become bigger thereby affecting the data accuracy and reliability.

From Table 4, it can be seen that RegPlus offered a very flexible opportunity in selecting any unit block dimensions of choice for the block model regularisation. The total tonnage and grade of the regularised block model for the all the scenarios remain the same for all the ore categories. It can be concluded from Table 4 that irrespective of the selected regularised unit block dimensions, the resultant data is very accurate and reliable when RegPlus is used to regularise the block model.

Table 1 Summary of Regularised Block Model Evaluation Report of Blk5 Block Model

Parameter	Unit	Original Block Model	Sc1	Sc2	Sc3	Sc4	Sc5
X-Dimension	m	5.0	20.0	25.0	15.0	30.0	50.0
Y-Dimension	m	25.0	20.0	10.0	25.0	38.0	42.0
Z-Dimension	m	6.0	9.0	8.0	6.0	5.0	2.5
Proved Tonnes	t	0	0	0	0	0	0
Proved Grade	g/t	0.00	0.00	0.00	0.00	0.00	0.00
Probable Tonnes	t	53 789	53 789	53 789	53 789	53 789	53 789
Probable Grade	g/t	1.17	1.17	1.17	1.17	1.17	1.17
Inferred Tonnes	t	0	0	0	0	0	0
Inferred Grade	g/t	0.00	0.00	0.00	0.00	0.00	0.00
Total Ore Tonnes	t	53 789	53 789	53 789	53 789	53 789	53 789
Total Ore Grade	g/t	1.17	1.17	1.17	1.17	1.17	1.17
Total Material	t	344 759	344 759	344 759	344 759	344 759	344 759
Strip Ratio		5.4:1	5.4:1	5.4:1	5.4:1	5.4:1	5.4:1

Table 2 Block Model Evaluation Report – Tomento North Pit1 Block Model Regularised Using Geovia Surpac

Parameter	Unit	Original Block Model	Sc1	Sc2	Sc3	Sc4	Sc5	Sc6	Sc7	Sc8	Sc9	Sc10
X-Dimension	m	10	5	10	10	15	25	30	40	50	100	50
Y-Dimension	m	10	5	10	10	15	25	25	35	50	50	100
Z-Dimension	m	3	5	9	10	9	6	6	8	5	9	20
Proved tonnes	t	0	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A
Proved Grade	g/t	0.00	N/A	0.00	N/A	N/A	N/A	N/A	N/A	N/A	0.00	N/A
Probable Tonnes	t	182 681	N/A	182 681	N/A	N/A	N/A	N/A	N/A	N/A	182 681	N/A
Probable Grade	g/t	2.44	N/A	2.44	N/A	N/A	N/A	N/A	N/A	N/A	2.44	N/A
Inferred Tonnes	t	0	N/A	0	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A
Inferred Grade	g/t	0.00	N/A	0.00	N/A	N/A	N/A	N/A	N/A	N/A	0.00	N/A
Total Ore Tonnes	t	182 681	N/A	182 681	N/A	N/A	N/A	N/A	N/A	N/A	182 681	N/A
Total Ore Grade	g/t	2.44	N/A	2.44	N/A	N/A	N/A	N/A	N/A	N/A	2.44	N/A
Total Material	t	2759 792	N/A	2759 792	N/A	N/A	N/A	N/A	N/A	N/A	2759 792	N/A
Strip Ratio		14.1:1	N/A	14.1:1	N/A	N/A	N/A	N/A	N/A	N/A	14.1:1	N/A
Metal Content	g	446 308	N/A	446 308	N/A	N/A	N/A	N/A	N/A	N/A	446 308	N/A

Table 3 Block Model Evaluation Report – Tomento North Pit1 Block Model Regularised Using Datamine Software

Parameter	Unit	Original Block Model	Sc1	Sc2	Sc3	Sc4	Sc5	Sc6	Sc7	Sc8	Sc9	Sc10
X-Dimension	m	10	5	10	10	15	25	30	40	50	100	50
Y-Dimension	m	10	5	10	10	15	25	25	35	50	50	100
Z-Dimension	m	3	5	9	10	9	6	6	8	5	9	20
Proved tonnes	t	0	0	0	0	0	0	0	0	0	0	0
Proved Grade	g/t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Probable Tonnes	t	182 681	180 467	179 378	177 844	174 734	171 981	172 135	168 182	165 499	164 634	157 898
Probable Grade	g/t	2.44	2.41	2.37	2.35	2.29	2.30	2.28	2.17	2.16	2.06	1.95
Inferred Tonnes	t	0	0	0	0	0	0	0	0	0	0	0
Inferred Grade	g/t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Ore Tonnes	t	182 681	180 467	179 378	177 844	174 734	171 981	172 135	168 182	165 499	164 634	157 898
Total Ore Grade	g/t	2.44	2.41	2.37	2.35	2.29	2.30	2.28	2.17	2.16	2.06	1.95
Total Material	t	2759 792	2741 400	2733 920	2710 800	2728 427	2733 692	2735 414	2700 660	2724 092	2671 628	2643 716
Strip Ratio		14.1:1	14.2:1	14.2:1	14.2:1	14.6:1	14.9:1	14.9:1	15.1:1	15.5:1	15.2:1	15.7:1
Metal Content	g	446 308	435 554	424 521	417 665	399 808	395 465	392 919	365 216	356 763	339 897	307 740

Table 4 Block Model Evaluation Report – Tomento North Pit1 Block Model Regularised Using RegPlus

Parameter	Unit	Original Block Model	Sc1	Sc2	Sc3	Sc4	Sc5	Sc6	Sc7	Sc8	Sc9	Sc10
X-Dimension	m	10	5	10	10	15	25	30	40	50	100	50
Y-Dimension	m	10	5	10	10	15	25	25	35	50	50	100
Z-Dimension	m	3	5	9	10	9	6	6	8	5	9	20
Proved tonnes	t	0	0	0	0	0	0	0	0	0	0	0
Proved Grade	g/t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Probable Tonnes	t	182 681	182 681	182 681	182 681	182 681	182 681	182 681	182 681	182 681	182 681	182 681
Probable Grade	g/t	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44
Inferred Tonnes	t	0	0	0	0	0	0	0	0	0	0	0
Inferred Grade	g/t	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Ore Tonnes	t	182 681	182 681	182 681	182 681	182 681	182 681	182 681	182 681	182 681	182 681	182 681
Total Ore Grade	g/t	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44
Total Material	t	2759 792	2759 792	2759 792	2759 792	2759 792	2759 792	2759 792	2759 792	2759 792	2759 792	2759 792
Strip Ratio		14.1:1	14.1:1	14.1:1	14.1:1	14.1:1	14.1:1	14.1:1	14.1:1	14.1:1	14.1:1	14.1:1
Metal Content	g	446 308	446 308	446 308	446 308	446 308	446 308	446 308	446 308	446 308	446 308	446 308

4 Conclusions and Recommendation

4.1 Conclusions

The following conclusions were drawn from the study:

- The JavaScript program (RegPlus) developed in this study is capable of performing block regularisation as confirmed by the test results (Fig. 9) obtained after using the RegPlus program to regularise the Blk 5 centroid block model.
- Unlike Geovia Surpac and Datamine software, the RegPlus program is capable of regularising any block model into into another block model with the preferred unit block dimensions. This is confirmed from the results (Fig. 3, Fig. 4 and Fig. 5) obtained after regularising the Tomento North Pit 1 block model with Geovia Surpac, Datamine and RegPlus.
- RegPlus gives an unlimited flexibility in the selection of unit block dimensions.

4.2 Recommendation

It is recommended that AGL uses RegPlus to generate regularised block models with any preferred unit block dimensions as required by Whittle Four-x for pit optimisation and Runge XPAC for production scheduling.

Acknowledgement

We are grateful to the Management of Abosso Goldfields Limited (AGL), especially the General Manager, Marcus Brewster and Mr John Ankomah, the Mine Planning Unit Manager of AGL for their assistance during the data collection. We also thank Assoc. Prof S. Al-Hassan of the University of Mines and Technology (UMaT) for his assistance.

References

- Anon. (2011), "JavaScript", <https://en.m.wikipedia.org/wiki/JavaScript>, Accessed: September 25, 2015.
- Anon. (2013a), "Geological Modelling", *Studio Geological Modelling User Guide*, CAE Mining Corporate Limited, 21 pp.
- Anon. (2013b), "Working with Block Models", *Geological Modelling Tutorial*, CAE Mining Corporate Limited, pp. 1- 4.

- Anon. (2013c), “Datamine Commands and Processes”, *CAE Mining Help Documentation*, CAE Mining Corporate Limited, pp. 42-55.
- Anon. (2013d), “Scripting and Automation”, *Studio Scripting User Guide*, CAE Mining Corporate Limited, pp. 1-12
- Barber, J. (2011), “Gemcom Minex™ Geology and Mine Planning for Stratified Deposits”, *White Paper on 2D and 3D Models*, Gemcom Software International Inc., 10 pp.
- David, M. (1977), *Geostatistical ore Reserve Estimation*, Elsevier Scientific Publishing Company, Amsterdam, The Netherlands, 363 pp.
- Davis, John C. (1986), *Statistical and Data Analysis in Geology*, 2nd Edition, John Wiley & Sons, New York, USA, 646 pp.
- Hack, D. R. (2003), “Utilisation of Scripting Languages for Customisation of Mine Planning Packages by Specialised Users”, *Application of Computers and Operations Research in the Mineral Industries*, South African Institute of Mining and Metallurgy, 115 pp.
- Noble, Alan C. (1992), “Ore Reserve/Resource Estimation”, *SME Mining Engineering Handbook*, Ed. Howard L. Hartman, 2nd Edition, Volume 1, pp. 344 - 362.

Authors



D. Mireku-Gyimah is a Professor of Mining Engineering and a Consulting Engineer currently working at the University of Mines and Technology, Tarkwa, Ghana. He holds the degrees of MSc from the Moscow Mining Institute, Moscow, Russia, and PhD and DIC from the Imperial College of Science, Technology and Medicine, London, UK. He is a member of Institute of Materials, Minerals and Mining of UK and New York Academy of Sciences and also a fellow of Ghana Institution of Engineers and the Ghana Academy of Arts and Science. His research and consultancy works cover Mine Design and Planning, Mine Feasibility Study, Operations Research, Environmental Protection and Corporate Social Responsibility Management.



Samuel Kwesi Takyi is a certified Mining Manager and a Consulting Engineer. He holds a Bachelor of Science degree in Mining Engineering from the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. He obtained his Master of Philosophy degree in Mining Engineering from the University of Mines and Technology (UMaT), Tarkwa, Ghana. His research and consultancy works cover Mine Design and Planning and Mining Business Improvement.