WHEN THE CONVERSATION TURNS
TO <mark>GOLD</mark>, PEOPLE TELL LIES.

From MURPHY's laws

WHAT IS WRONG WITH "RESMODEL" BLOCK MODELS OF TUKHMANUK DEPOSIT?
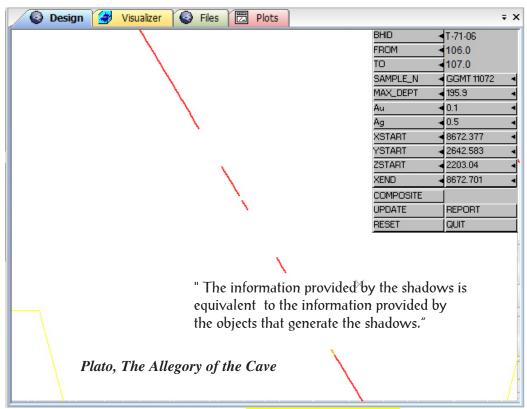
Tukhmanuk, Aparan, Armenia
30.04.2015

Preface:

Block model is a general term for a set of virtual parallelepipeds forming a body of a natural phenomenon and populated with values. Values are obtained from field work techniques, known as drilling, trenching, channel sampling, etc. We will consider drill hole sampling apparently used for RESMODEL construction.
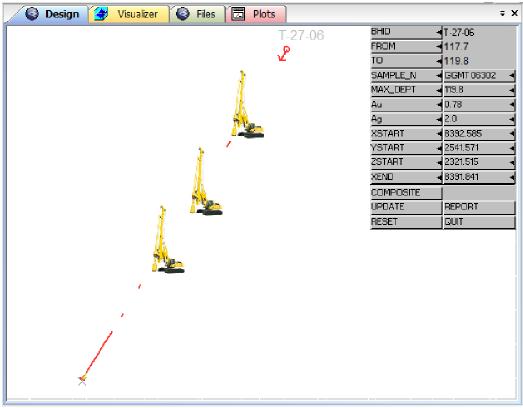
PART I, ERRORS

Chapter1. Drill Hole trace errors.

Drill hole trace is a *continuous* line (straight or curved) drawn is space following the drill bit penetration trajectory through the rock. Every second drill hole used for RESMODEL is not continuous. That is, it brakes at some depth, then suddenly appears several metres deeper to remind about itself again metres deeper and so on.

" The information provided by the shadows is equivalent to the information provided by the objects that generate the shadows."

Plato, The Allegory of the Cave

Dwg.1 File TM_DHOLES. Drill hole trace T-71-06 is not *continuous*, it has the largest 17 metres phantom interval between sample #GGMT11055 and GGMT11072, and several smaller phantoms. The gaps are so big that you can add aphorisms of celebrities to fill the empty space up on the drawing.

Drill hole T-27-06 is the record holder with the hole trace indicating 40m fresh air
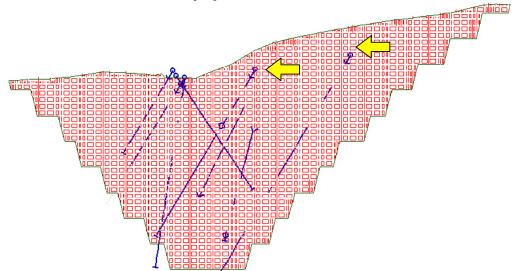interval in the drill hole RESMODEL block model is built out of.

BHID	◄	T-27-06	
FROM	◄	117.7	
TO	◄	119.8	
SAMPLE_N	◄	GGMT 06302	◄
MAX_DEPT	◄	119.8	◄
Au	◄	0.78	◄
Ag	◄	2.0	◄
XSTART	◄	8392.585	◄
YSTART	◄	2541.571	◄
ZSTART	◄	2321.515	◄
XEND	◄	8391.841	◄
COMPOSITE			
UPDATE		REPORT	
RESET		QUIT	

Dwg.2. Record holder T-27-06 can accommodate several drill rigs in a single gap.

Chapter2. Drill hole collar coordinate errors.

Unless in the unredground work face, drill hole collars are located on the terrain.
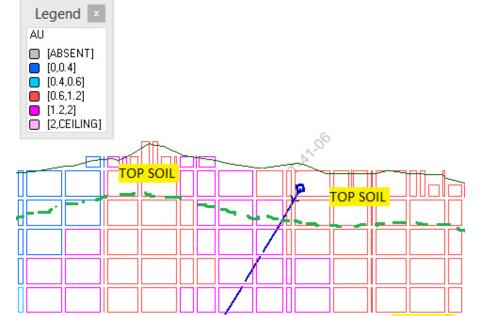
But some drill holes at Tukmanuk project start 22m below the terrain.

Dwg.3. Drill hole collars located <mark>over 20m below the surface</mark> in addition to phantom intervals of the hole traces.

Chapter 3. Geology errors.

NO geological interpretation of the rock being sampled at all both in drill holes and, as a result, in block model. Neither lithological interpretation, nor the minerazation. For no reason, lithology info found in surplus in the drill hole logs has not been included into the drill hole database. As a result, the RESMODEL block model would put the mine management in a silly position by reporting valuable grades in 10-12m thick top soil, weathered and washed out, normally being supposed to be stripped and dumped as waste, but thanks to the RESMODEL it "supposedly" ads up an extra phantom value to the reserves.

Dwg.4. Vertical section of RESMODEL. 10.7m thick top soil shows **AU 2.6 g/t** in the <mark>RESMODEL</mark> cells in close vicinity of the hole trace while the drill hole logs indicate top soil with the subgrade ore -- <mark>0.2 g/t</mark>.

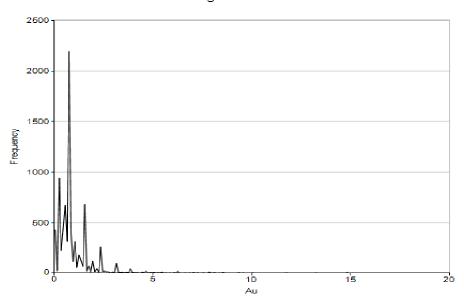| Լիթոլոգիական սյունակ		Ապարների տարբերակման միջակայքեր			Հանույքի ելքը		Ապարների տարբերակման միջակայքեր	Նմուշարկման միջ		
		սկիզբ pp	վերջը	ամբող ջը	մ	%		սկիզբ pp	վերջը	ամբող ջը
							0.0-9.9մ միջակայք Հողաբուսական ծածկույթ, որից հետո ` գորշ գույնի ավազների, ավազակավերի, կանաչավուն գույնի անդեզիտա-բազալտներով ներկայացված մանրախառիկ և կոպտա-հատիկ ապարների բեկոր-ների ենթաշերտերի հերթափոխումով,	0,00	1,00	1,00
								1,00	2,00	1,00
								2,00	3,00	1,00
								3,00	4,00	1,00
								4,00	5,00	1,00
								5,00	6,00	1,00
								6,00	7,00	1,00
								7,00	8,00	1,00
								8,00	9,00	1,00
		0.00	9.9	9.9	9.9	100.0		9,00	9,90	0,90
							9.9-13.9մ միջակայք Անդեզիտաբազալտներ, մուգ մոխրագույն, կոտոր-րակված, փշրված, երկա-թայնացված	9,90	10,90	1,00
								10,90	11,90	1,00
								11,90	12,90	1,00
		9.9	13.9	4.0	38.4	96		12,90	13,90	1,00
							1.9-34.2 մ միջակայք Անդեզիտաբազալտներ, մուգ մոխրագույն, տեղ-տեղ ժանգագույն, հիդրոթերմալ փոփխված, խիստ կոտո-րակված, որի հետևանքով ապարները վեր են ածվել կտորների: Ճեղքերը և ճաքերը լցված են ժանգի և գորշ գույնով, որոնք	13,90	14,90	1,00
								14,90	15,90	1,00
								15,90	16,90	1,00
								16,90	18,05	1,15
								18,05	19,05	1,00
								19,05	20,05	1,00
								20,05	21,05	1,00

Dwg.5. A shot of a drill hole log with lithological description as text. First goes 9.9m thick top soil. As any other geological information, <mark>lithology is missing in RESMODEL</mark>.

Chapter 4. No respect to statistics.

Histogram plot reveals pattern different from log-normal (bell shape) distribution at 0.1 bin size.

Histogram for Au

Dwg.6. Frequency distribution of Au in TM_DHOLES out of which RESMODEL block model has been constructed. The stepped appearance could be accounted for the spread of measurements around one and the same value, that is **precision of the readings is questionable.** As long as the precision is quite spread out, **the measurements are not accurate,** too, except of those few incidental readings where the reading accounts for true value simply by chance.

PART 2. "It never hurts to try" -- Or else, What happens when positive expectations come across with negative interpretations.
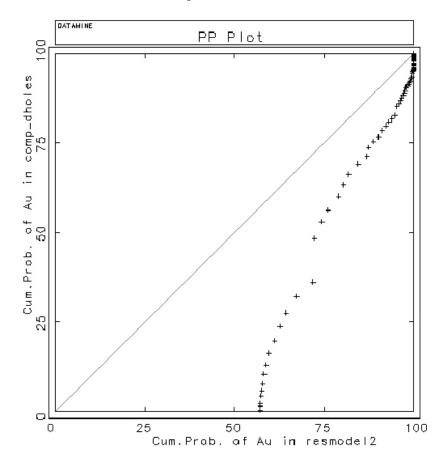
Chapter 5.

> P-P Plot plots a variable's cumulative proportions against the cumulative proportions of any of a number of test distributions. Probability plots are generally used to determine whether the distribution of a variable matches a given distribution. If the selected variable matches the test distribution, the points cluster around a straight line.

This is general explanation of P-P plots. **Datamine Studio 3** uses this technique in a rather demonstrative way, providing both theoretical explanation coupled with graphical depiction of the results. According to Datamine help system:
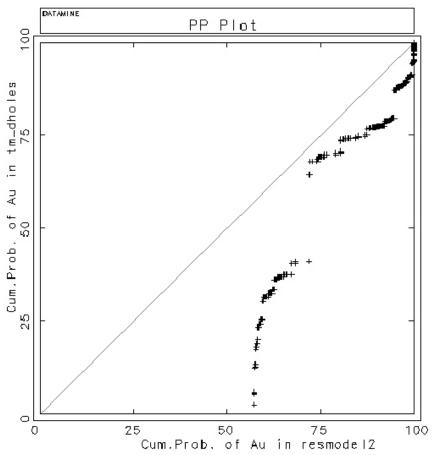
> The PP plot is a plot of the cumulative probability of the first data set against the cumulative probability of the second data set for a series of cutoff grades. If the two sets come from a population with the same distribution, the points should fall approximately along the 45 degree reference line.

In RESMODEL case, we compare drill holes (out of which block model is constructed) with the block model to check if they share the same distribution.

Dwg.7. P-P plot of "RESMODEL" block model against "comp_dholes" drill holes

Dwg.8. P-P plot of "RESMODEL" block model against "TM_dholes" static drill holes

We talk about one and the same locality. So, that the distribution is to be the same because the assays from holes are interpolated into the block model cells based on some distribution law.
P-P plot shows a great departure from diagonal line as if the distributions are not the same, or as if the drill holes are drilled somewhere except the Tukmnanuk site.
This happens when estimation parameters are chosen at random without any knowledge of the subject. Therefore, **RESMODEL block models are not usable:**

- Drill hole values are questionable (Chapter 4).
- Drill holes are built up incorrectly (Chapter 1).
- Block model shows no top soil with subgrade ore. Instead, it shows over 2g/t AU grade instead of it (Chapter 3). *Besides, ore zones are not controlled with wireframes. Simply by chance waste cells reached by search radius will be populated with grades, same as the top soil.*
- Block model pays no regard to geology (lithology, mineralization type) (Chapter 3).
- Block model cells are populated with values using wrong parametres (Chapter 5).

Conclusion.

There are too many unknown variables, objective and subjective, involved into the RESMODEL block model construction resulting in a failure. Any of the variable is important!

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