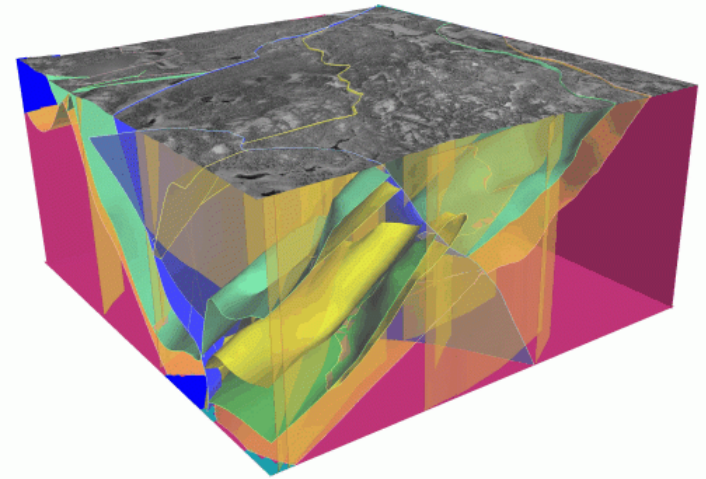# Rules of Thumb for Geological Modeling
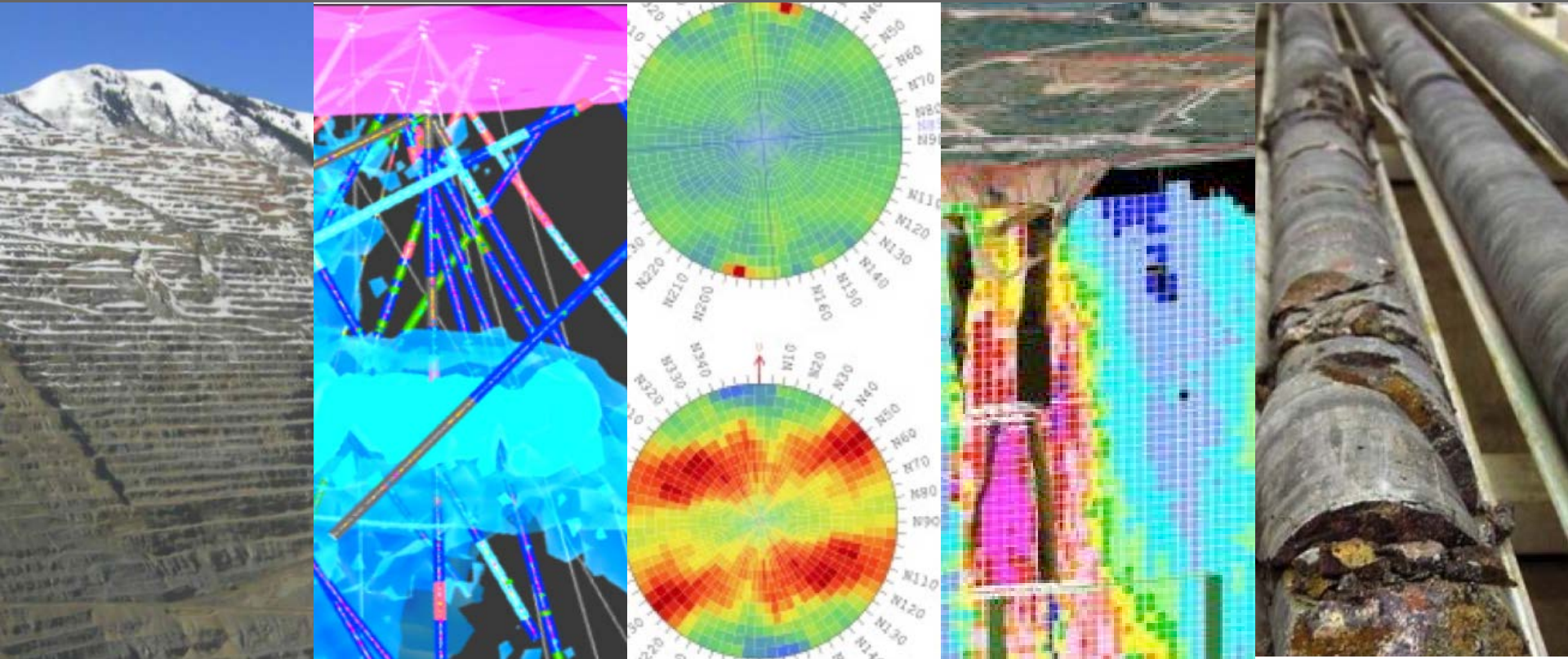

Erik C. Ronald, PG – SRK Consulting, Inc.

SME Annual Conference - Minneapolis

27 February 2018

Find the associated article at:
MiningGeologyHQ.com

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Introduction

- Geology and Geological models constitute the foundation of Mineral Resources and Ore Reserves of a project/mine;

- Block model is based on drilling and geology;

- Mine design and schedules based on block model;

- Economics based on Mine Plan;

- Business plan based on economics and mine plan;
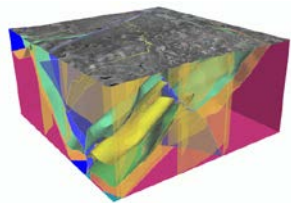
A Bit about Models…

- *"For such a model there is no need to ask the question 'Is the model true?' If 'truth' is to be the 'whole truth' the answer must be 'No'. The only question of interest is 'Is the model illuminating and useful?"* (Box, 1979)

- "All models are wrong, some are useful" (Box, 1979)

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Big Picture

- There is no "Perfect" or "Correct" model;

- There are poorly- or well-informed models;

- There are beneficial and useless models;

- Goal: a well-informed, useful model based on best available information (knowing it will change!)

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Merely Guidelines…

- These *Rules of Thumb* should be used for internalizing and questioning prior to creation or model updating;

- Not prescriptive…do step 1, then do step 2;

- Based on experience, not analytical evidence;

- Best tool for geological modeling =

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# What will the model be used for?

- Early exploration?
- Global Mineral Resources;
- Detailed Mine Planning;
- (Geo)Metallurgy;

- What aspects & variables are important for the model users/customers?

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Understand the Deposit Geology

- Model must adhere to the geochronologic sequence of ore body genesis;

- Must make geological sense;

- Respect relationships of units, structure, alteration, etc.

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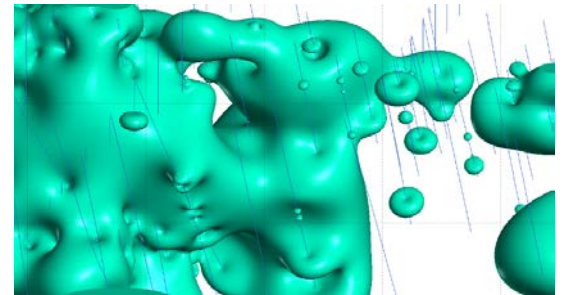
Incorporate all (trusted) data

- Desperation is the mother of innovation;

- Use more than just drilling!

- Most mines have excessive geologic data, need to use it;

- Don't forget maps, geomorphology, geophysics, water wells, road cuts, trenches, etc.

**Rules of Thumb for Geological Modeling**

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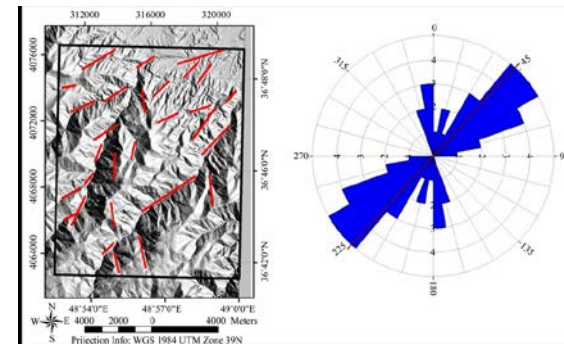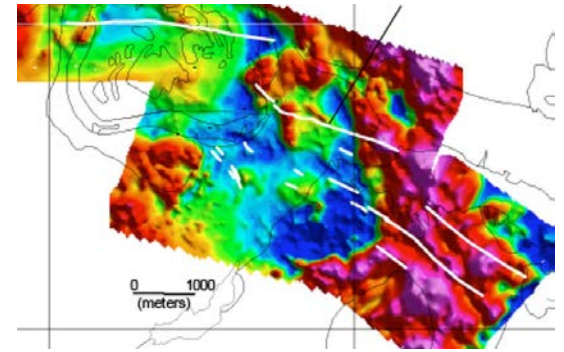
Know the Fundamental Data

- Get intimate with your data!

- Exploratory Data Analysis;

- Group and break apart, test, trial, and play;

- Domains are key to estimation, spend time to get them correct (see point 1);

- It's the most unsexy part…but means the difference between "good and bad".

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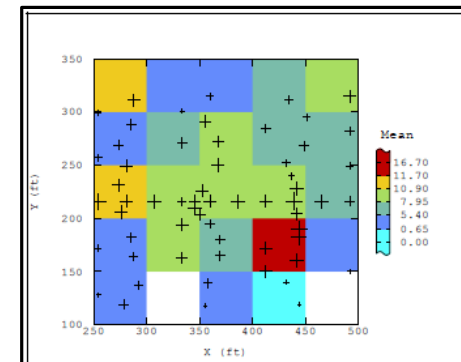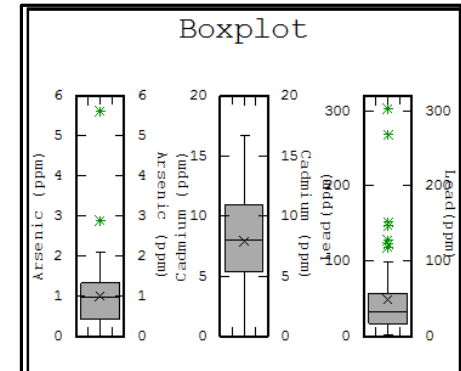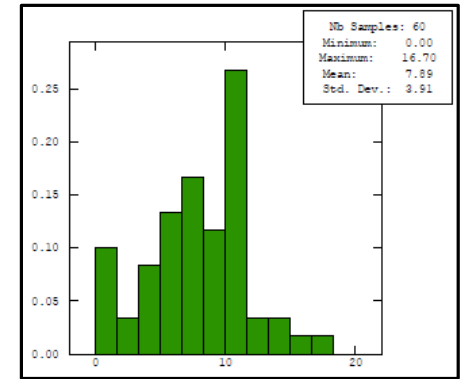
Think Regional, then model Deposit

- Deposit-scale geology is the result of regional structure;

- Start big picture, then work down to site or pit scale;

- Hard to see forest through the trees!

- Geology doesn't end at the pit boundary.

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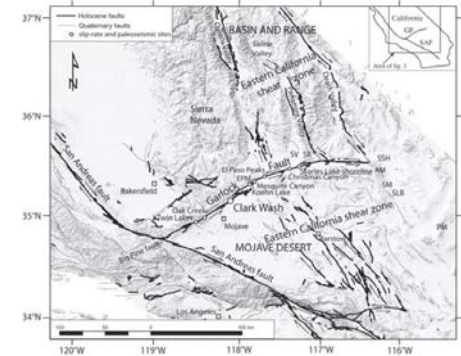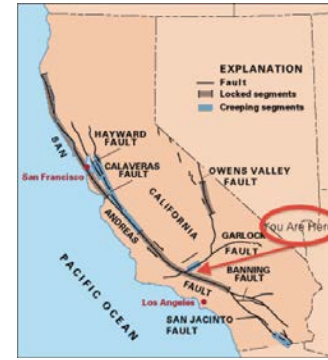
Start with a Structural Skeleton

- Most fluids are transported along structural weaknesses;

- Metal accumulation may be along traps (skarn) or pathways (veins);

- Follow the structure to find the metal;

- Easy to sort out stratigraphy once structure is modeled.

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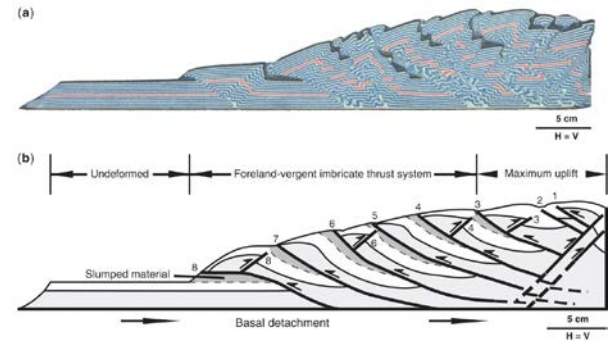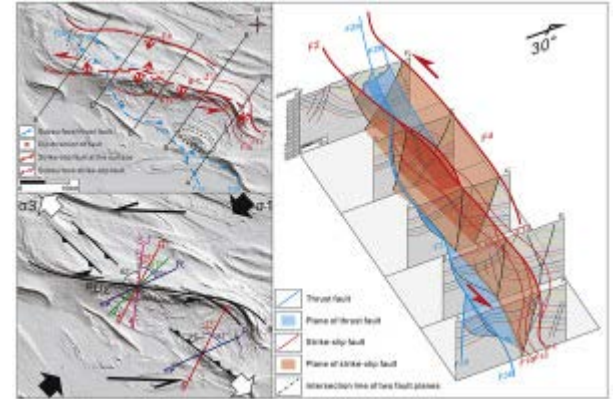
Keep it as Simple as it Needs to be

- "If you can't explain it simply, you don't understand it well enough";

- What is interesting and what is relevant are rarely the same thing;

- If it's important to the mine plan, it should be modeled.

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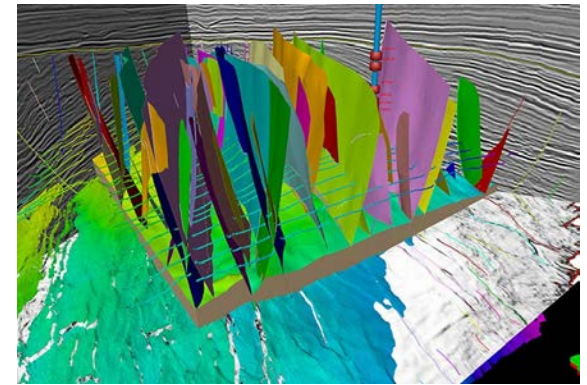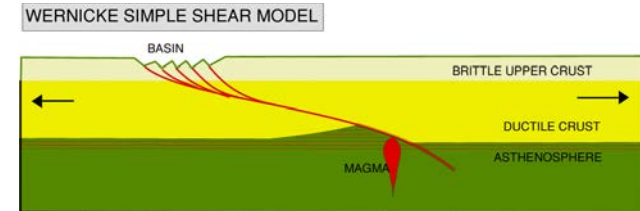
Don't Forget the Waste

- "We mine a lot more waste than ore, so you should probably understand that s#*t too" (anon mining engineer)

- Sometimes best geological information is in non-altered holes;

- Waste characterization.

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Reconcile Shapes in 3-D

- Avoid "Grandma's curtains"
- Cut multiple sections in non-standard directions across deposit to check;
- Beware in sectional interpretation;
- Need to check even in implicit modeling;

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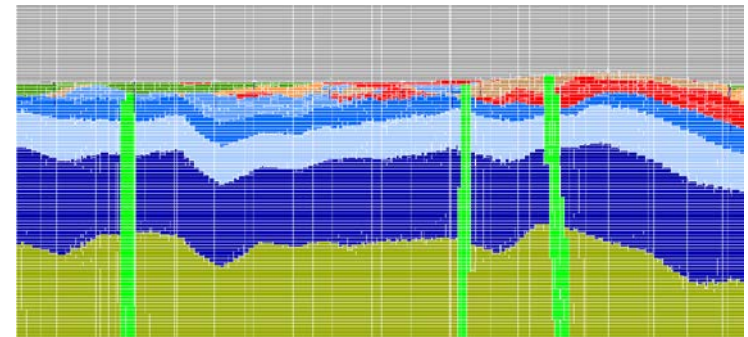
Take Aways

- Geological models are important;
- Understand use of model;
- Don't over complicate it;
- Use your brain, what makes geological sense;
- Understand the big picture;
- Get peer reviewed;

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Thank you

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