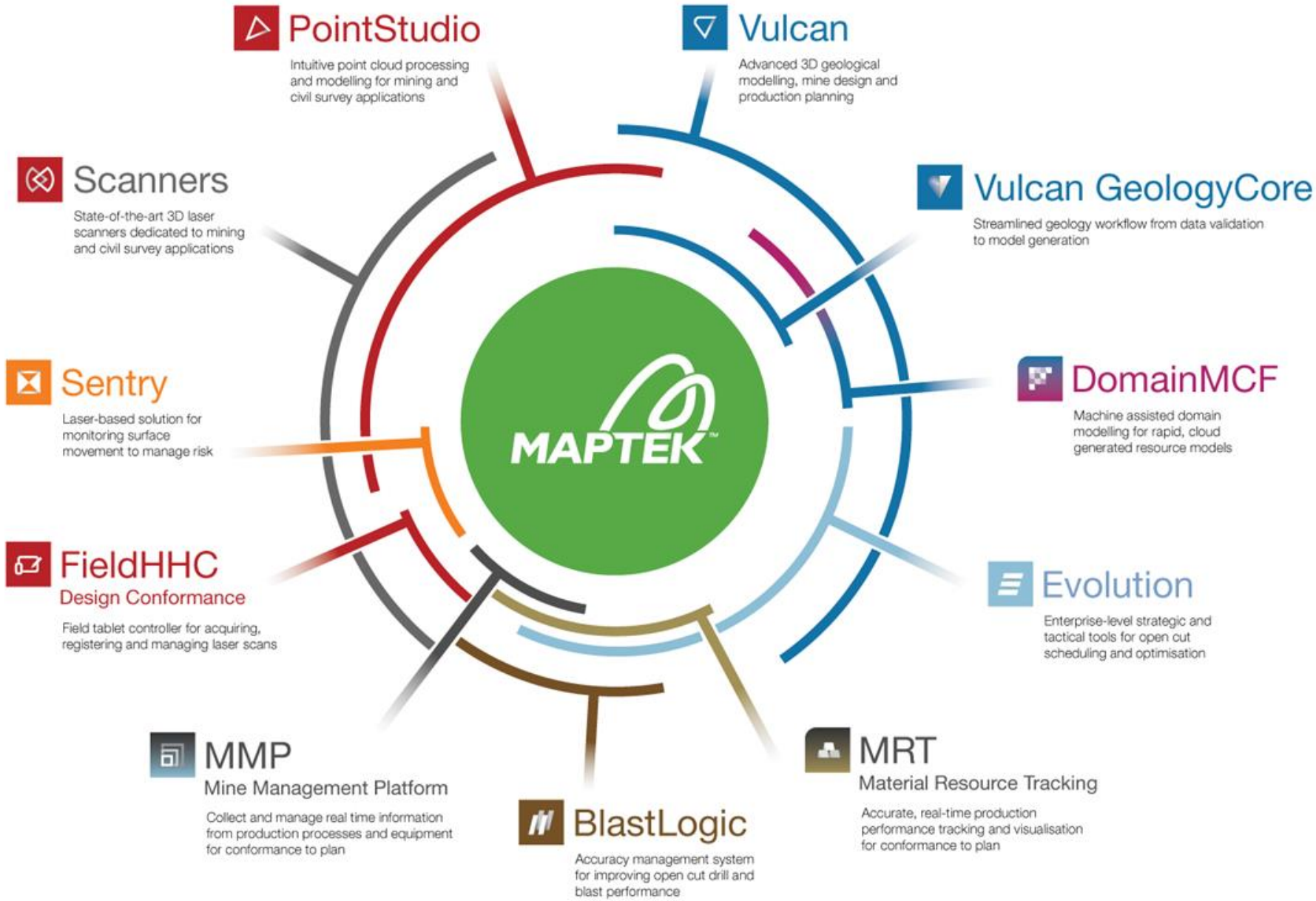
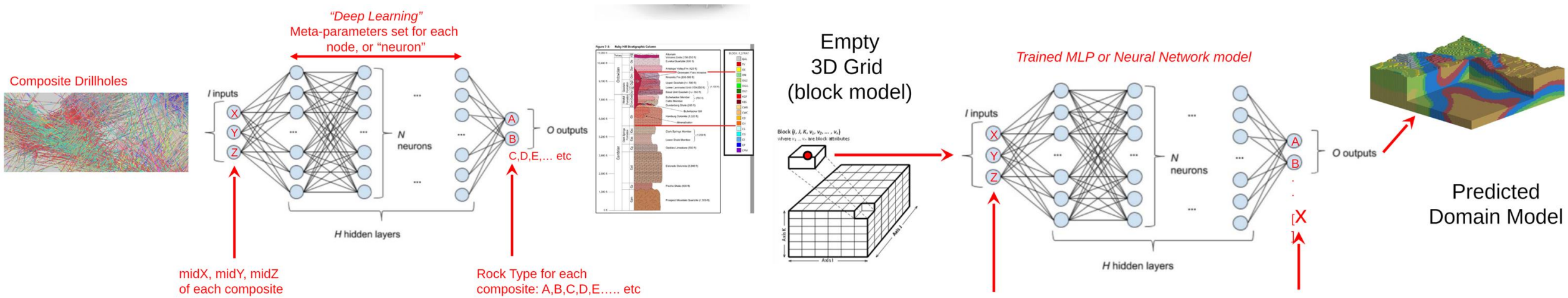
Learning to drive

A geologist's guide to machine learning

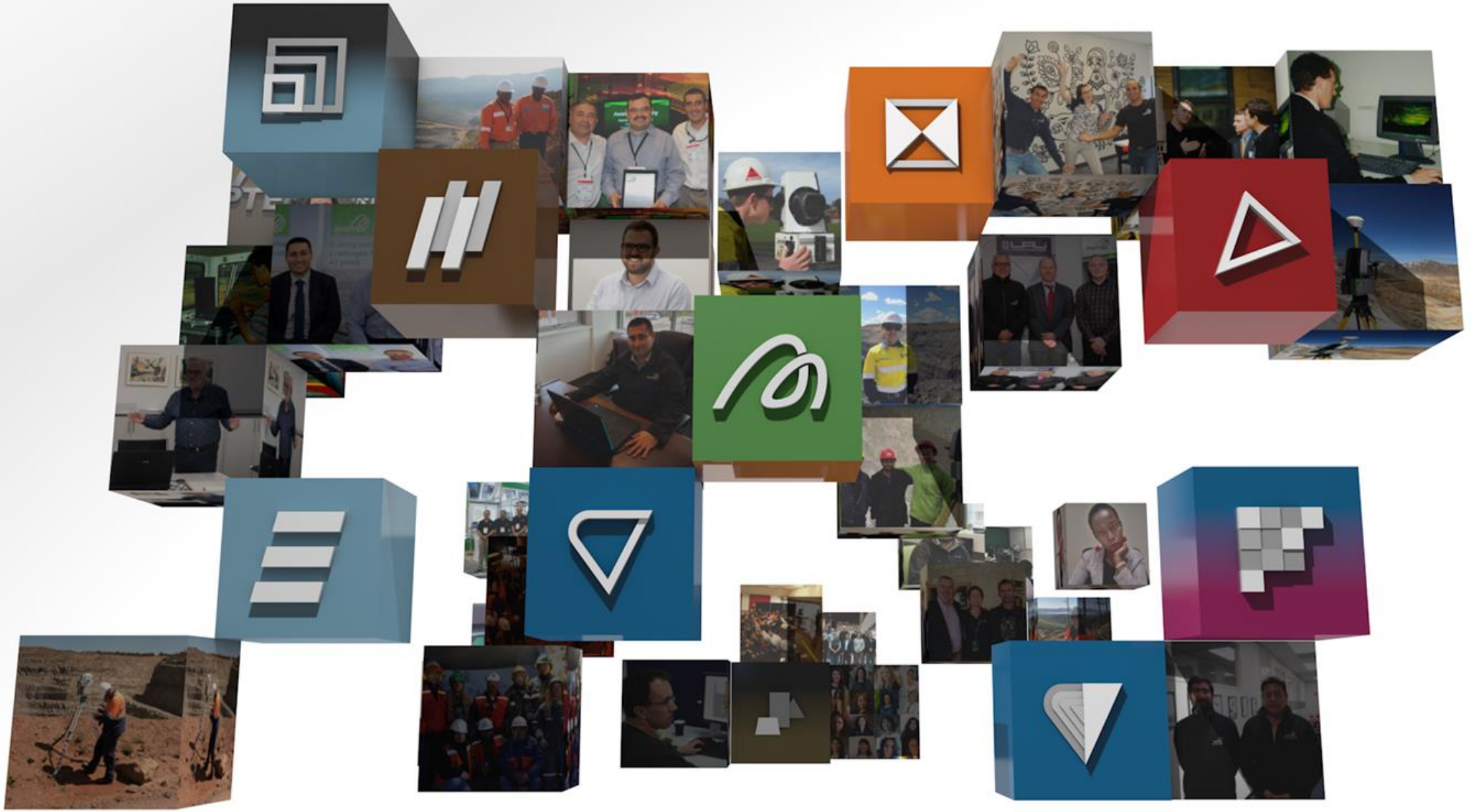

PointStudio
Intuitive point cloud processing and modelling for mining and civil survey applications
Vulcan
Advanced 3D geological modelling, mine design and production planning
Scanners
State-of-the-art 3D laser scanners dedicated to mining and civil survey applications
Vulcan GeologyCore
Streamlined geology workflow from data validation to model generation
MAPTEK
Sentry
Laser-based solution for monitoring surface movement to manage risk
DomainMCF
Machine assisted domain modelling for rapid, cloud generated resource models
FieldHHC
Design Conformance
Field tablet controller for acquiring, registering and managing laser scans
Evolution
Enterprise-level strategic and tactical tools for open cut scheduling and optimisation
MMP
Mine Management Platform
Collect and manage real time information from production processes and equipment for conformance to plan
BlastLogic
Accuracy management system for improving open cut drill and blast performance
MRT
Material Resource Tracking
Accurate, real-time production performance tracking and visualisation for conformance to plan

Maptek DomainMCF

Machine learning assisted domain modelling



Changing the way mining is done forever



Dictionary

Definitions from Oxford Languages · Learn more

machine learning

noun

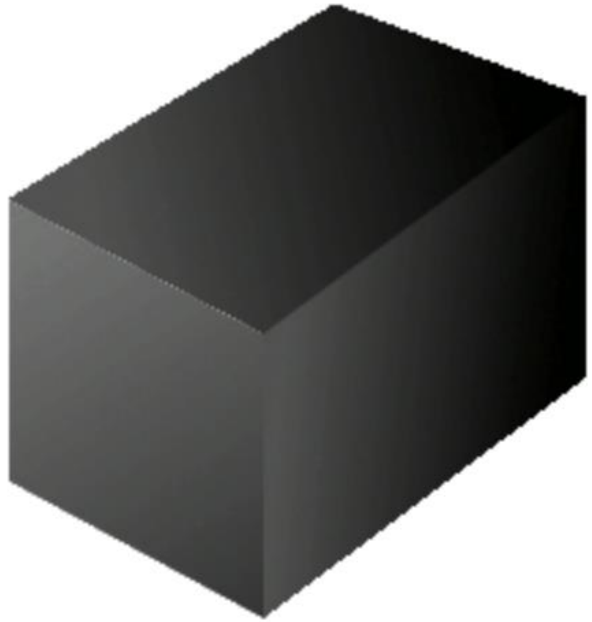
the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyse and draw inferences from patterns in data.
"the application of machine learning to biological databases has increased"

Machine learning for Geology?

Is it applicable to generating models?

- ☑ Learn and adapt without following explicit instructions.
- ☑ Draw inferences from patterns in data.

- ⚠ Black box?
- ⚠ Loss of geological control?



Machine learning for Geology?

Is it applicable to generating models?

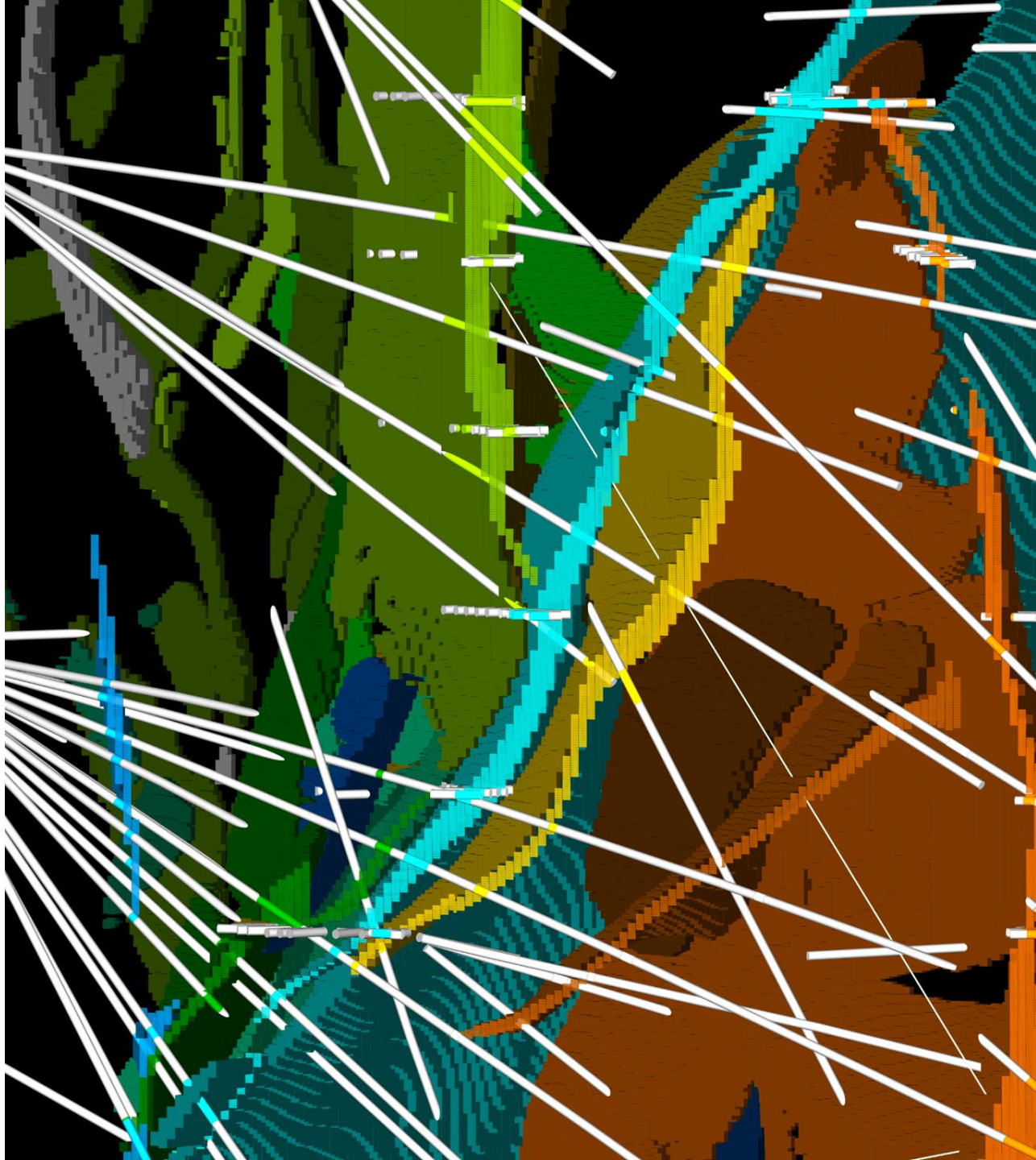
- ☑ Learn and adapt without following explicit instructions.
- ☑ Draw inferences from patterns in data.

- ☑ Open box!
- ☑ Lots of geological control!

Machine learned geology models are amazing!

They excel where:

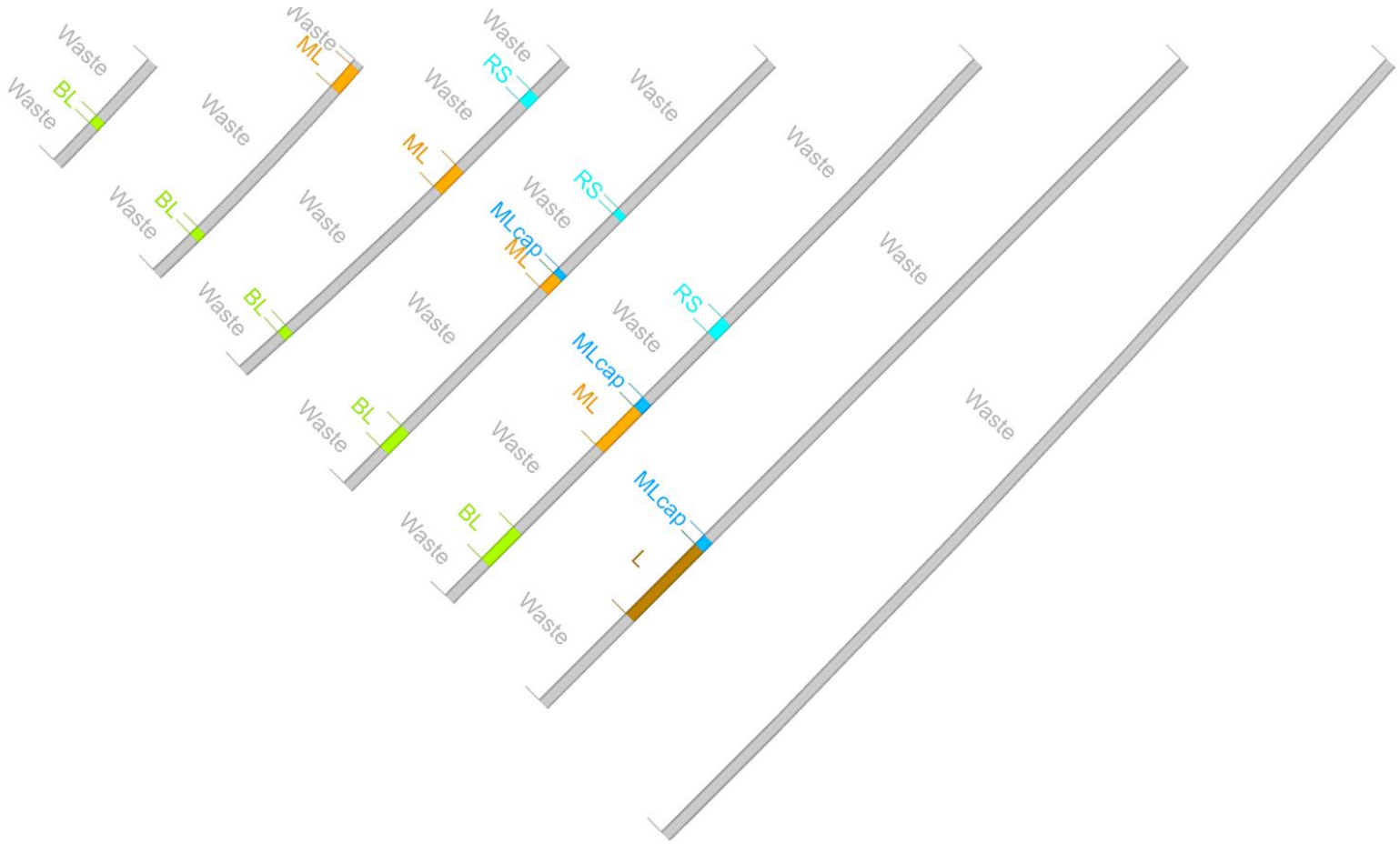
- Data is rich.
- Complexity is represented in data.
- Time is poor.
- Bias is unwanted.



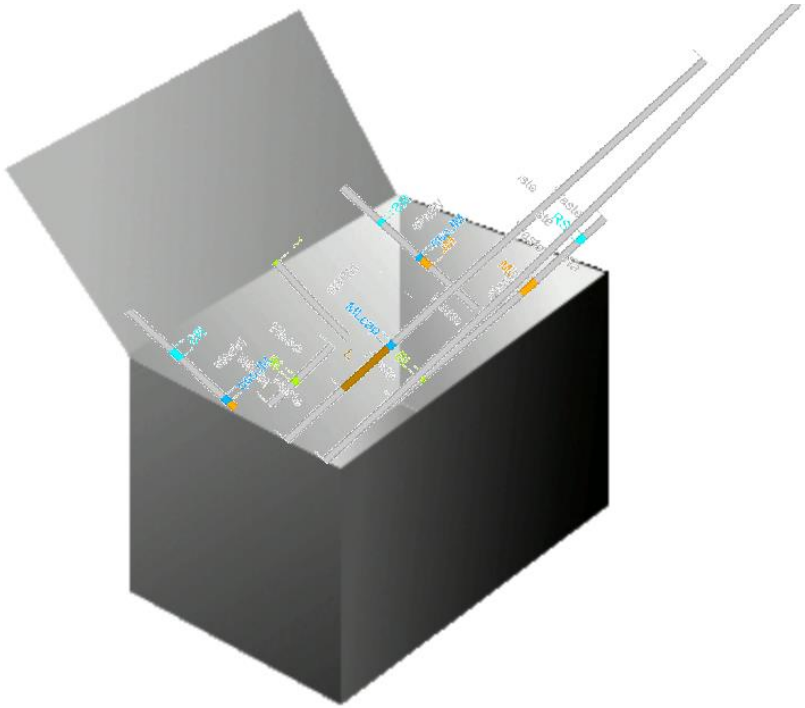
What if we don’t have all of that?

How do we control things when:

- Data quantity is poor?
- Complexity is not shown in the data?
- We want the best model?
- We want control?



Throw it all in the box and see?



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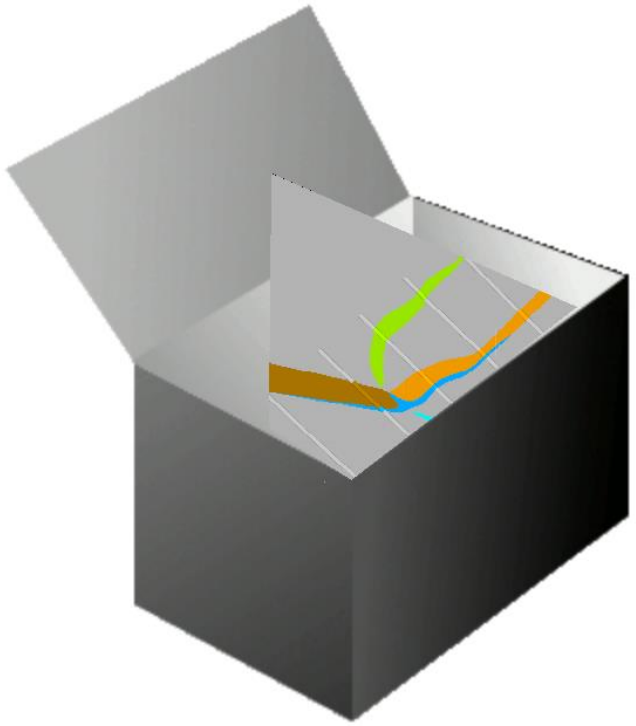
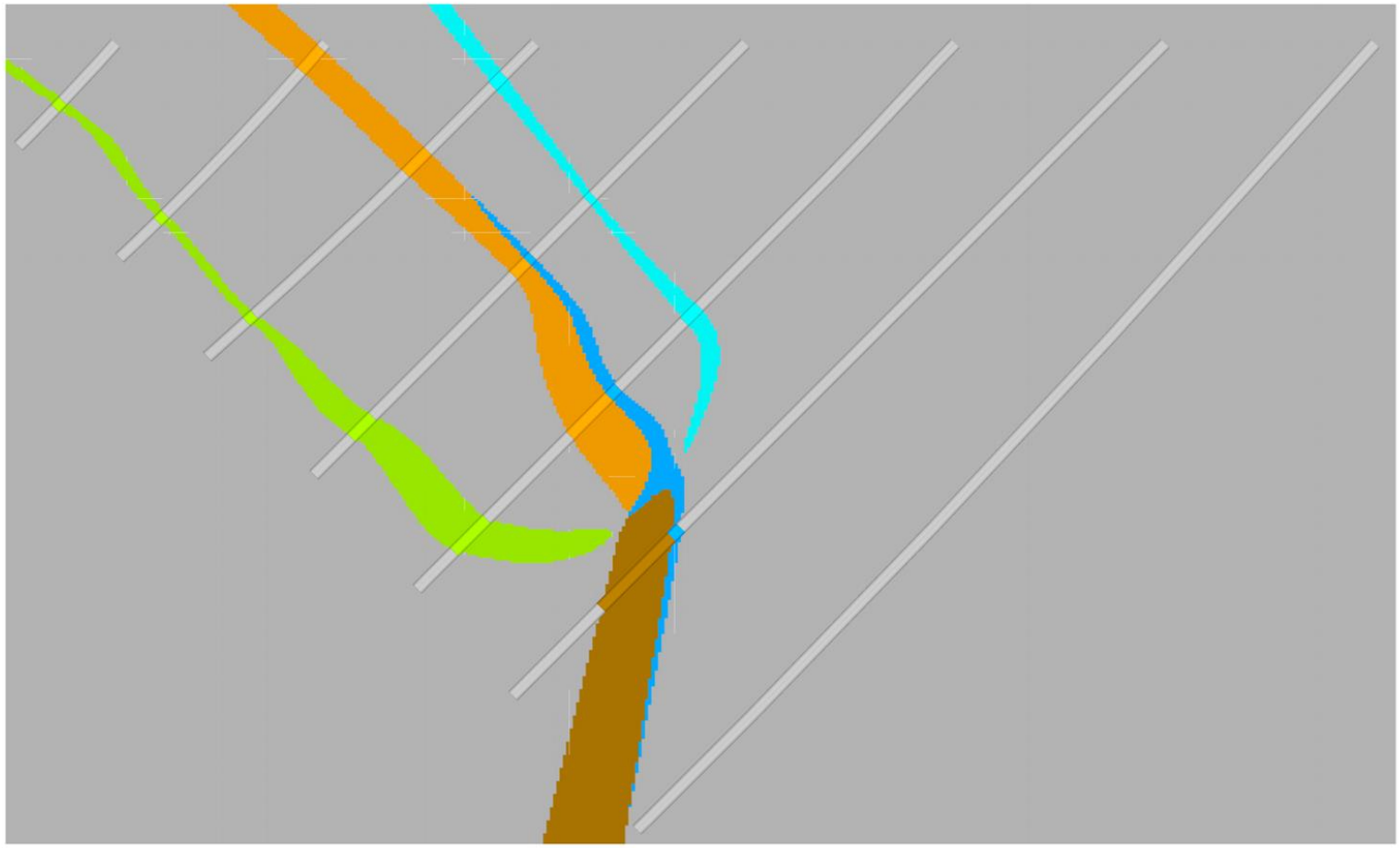


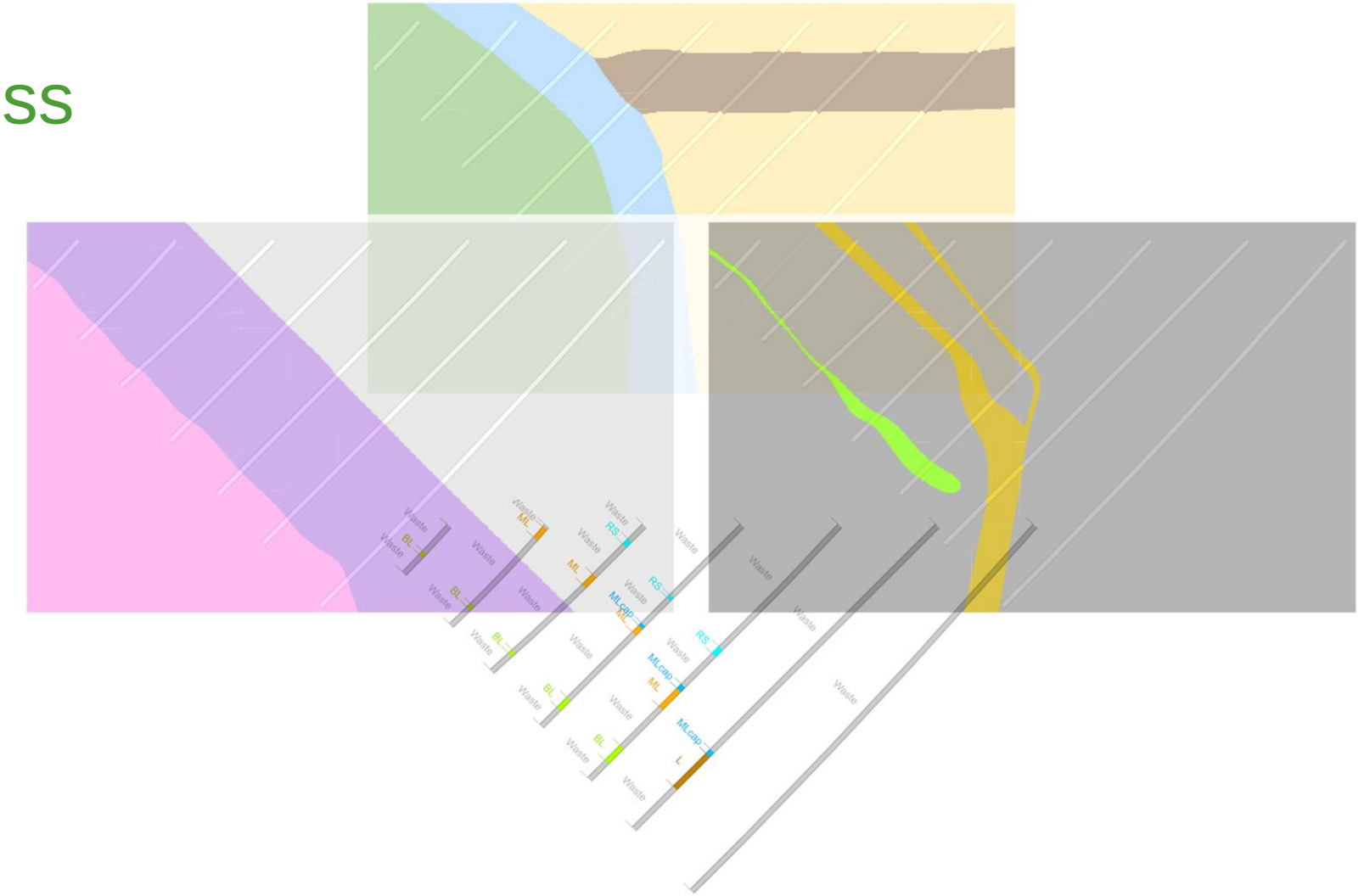


Pack up and try something else?

Step back and reassess

Have we given the machine all our data?

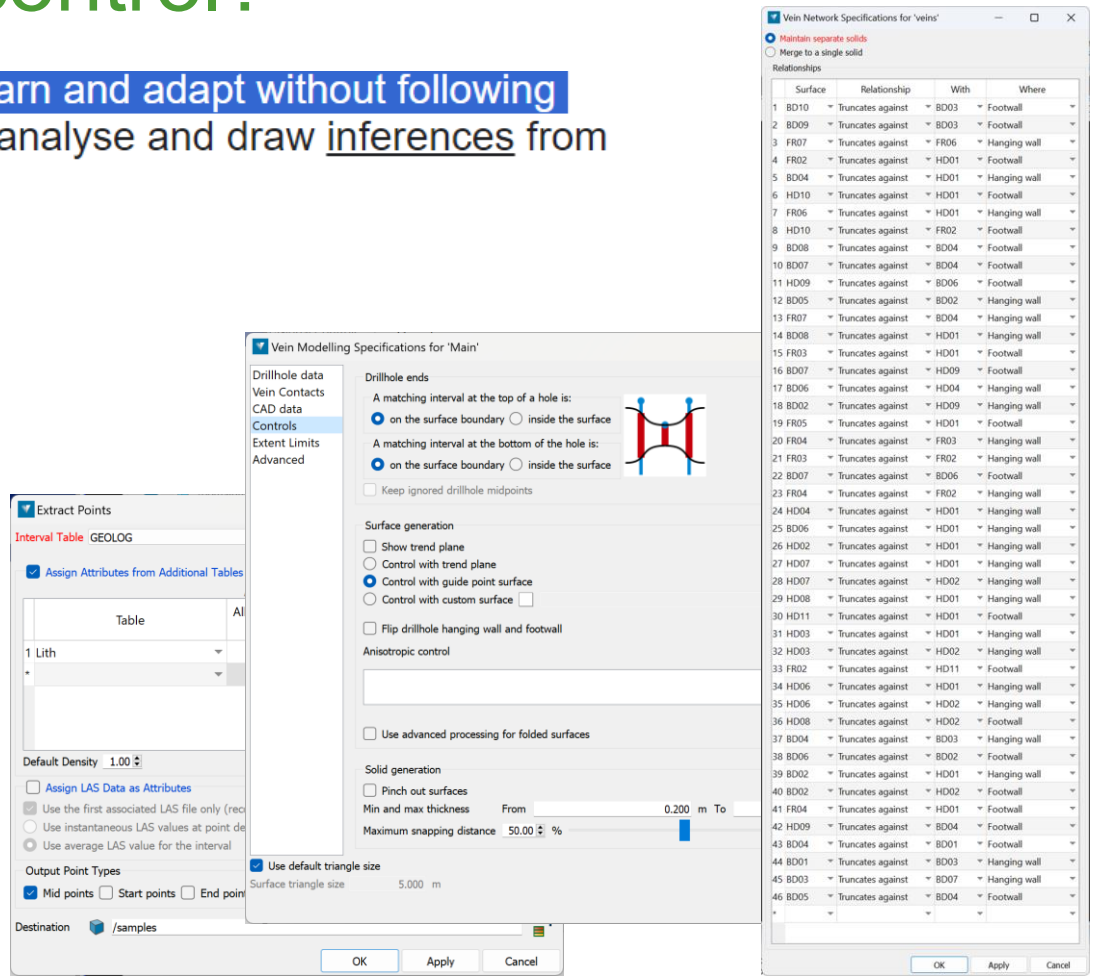
- Regional geology?
- Related lithology?
- Relationships within the domains?
- and between our chosen domains?



Doesn’t this sound like explicit control?

the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyse and draw inferences from patterns in data.

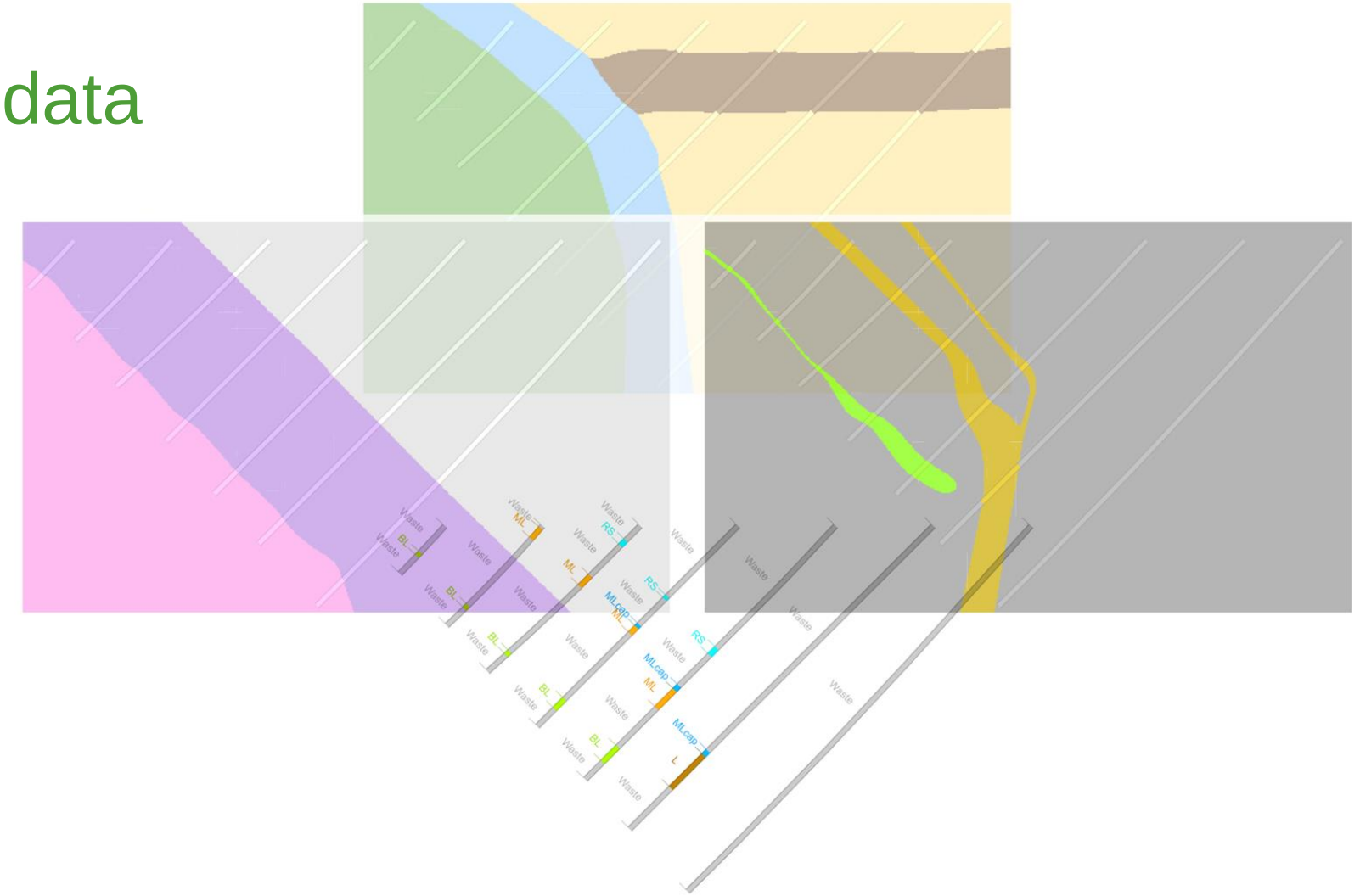
No



Provide all geological data

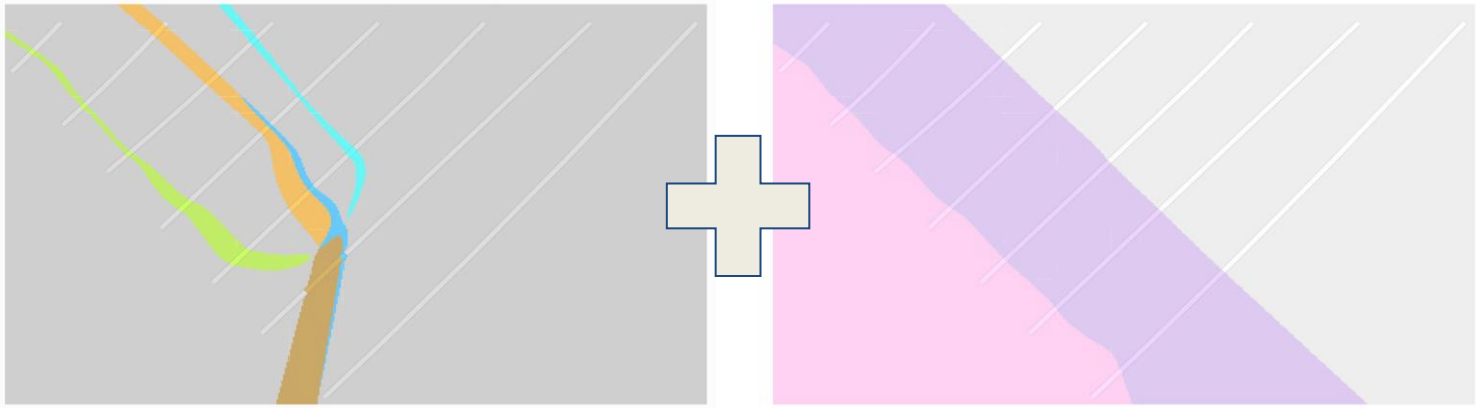
The machine learning can determine the pattern in the data

- We only need to provide the data, not the relationships.
- Machine learning is predicting the best match for our domains as it models all connected geology data together.

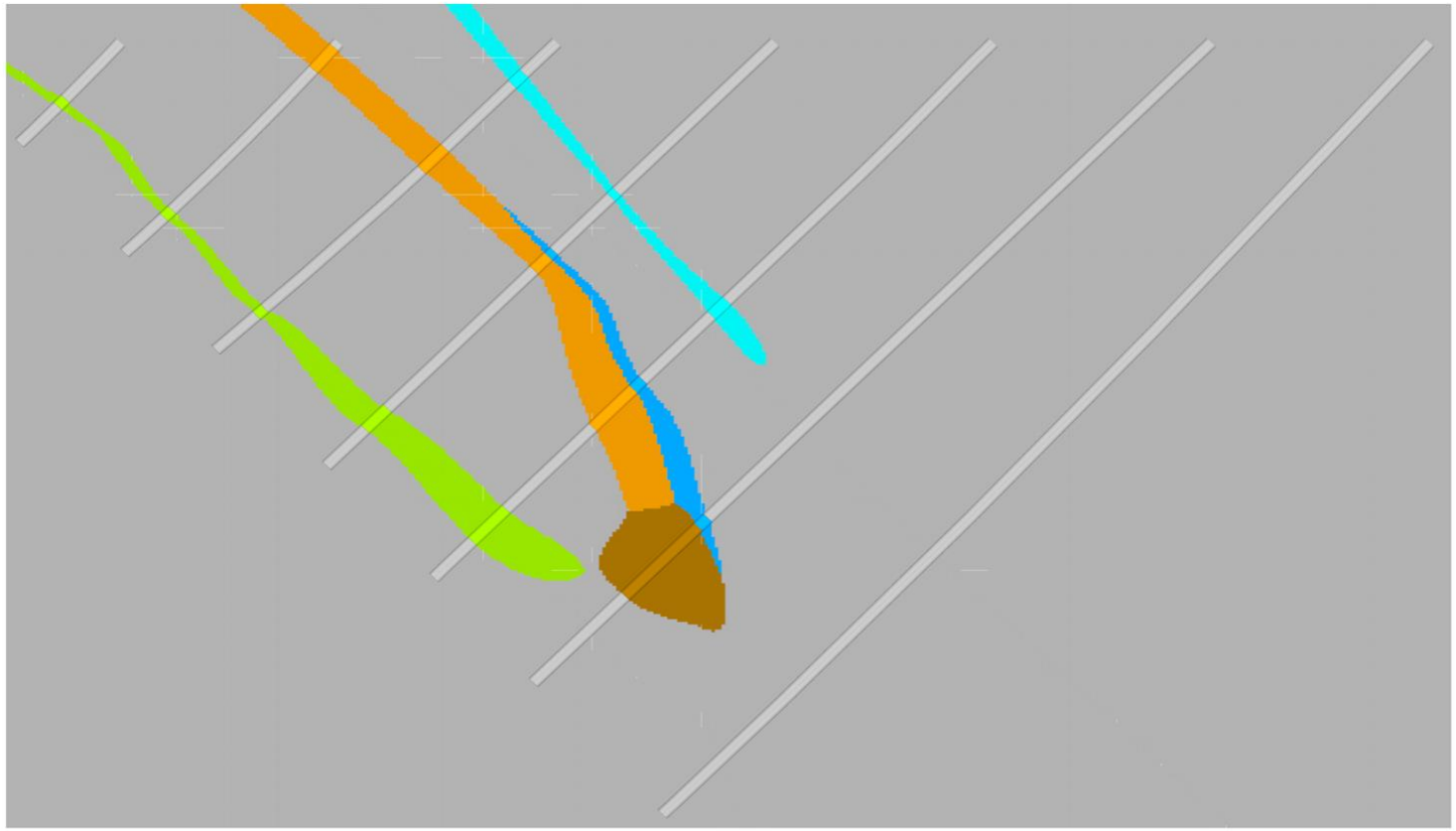


Domains + Structure

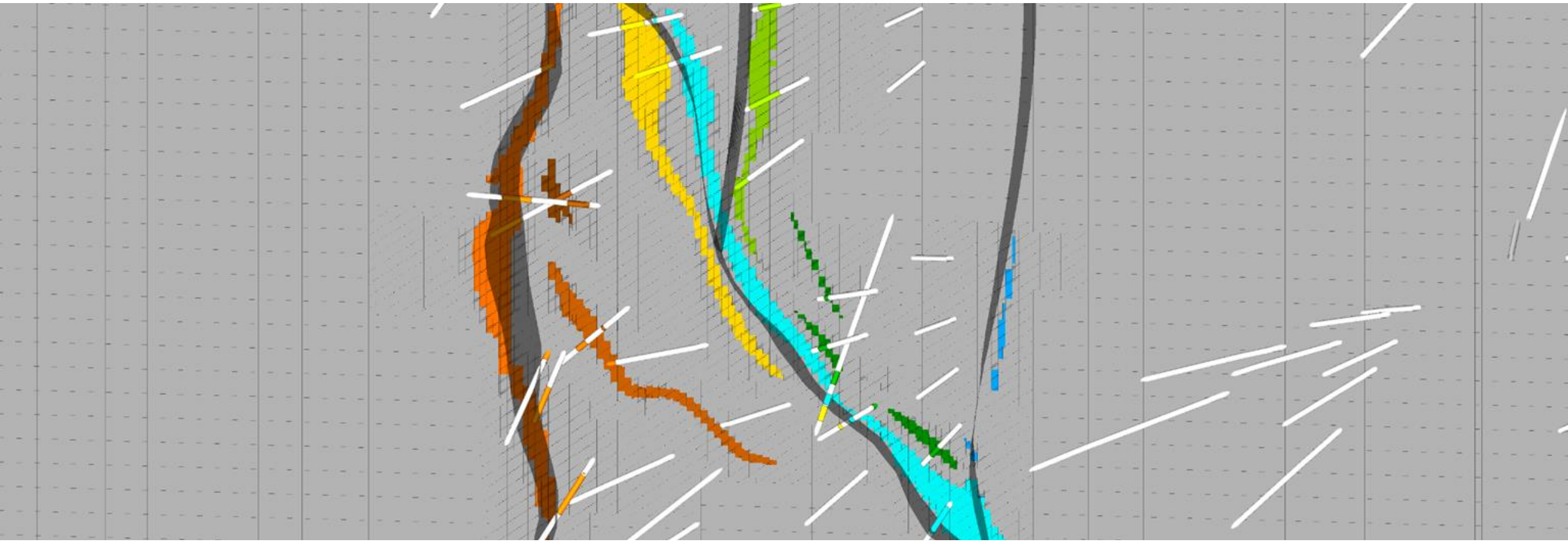
Guided by surfaces/solids



- Domains follow regional dip where data is sparse.
- Structural surfaces are a guide and not hard boundaries

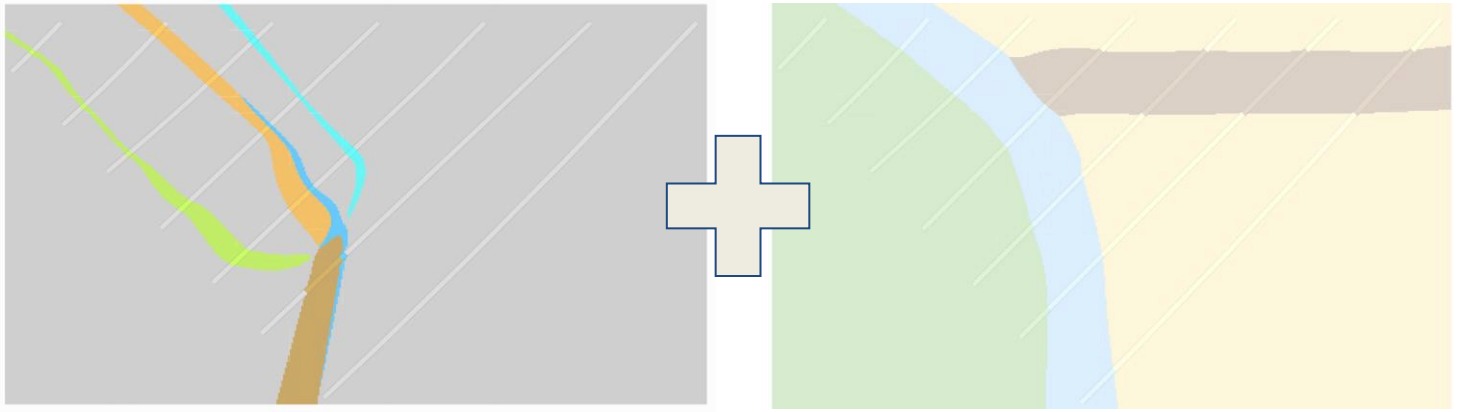


Domains + Structure

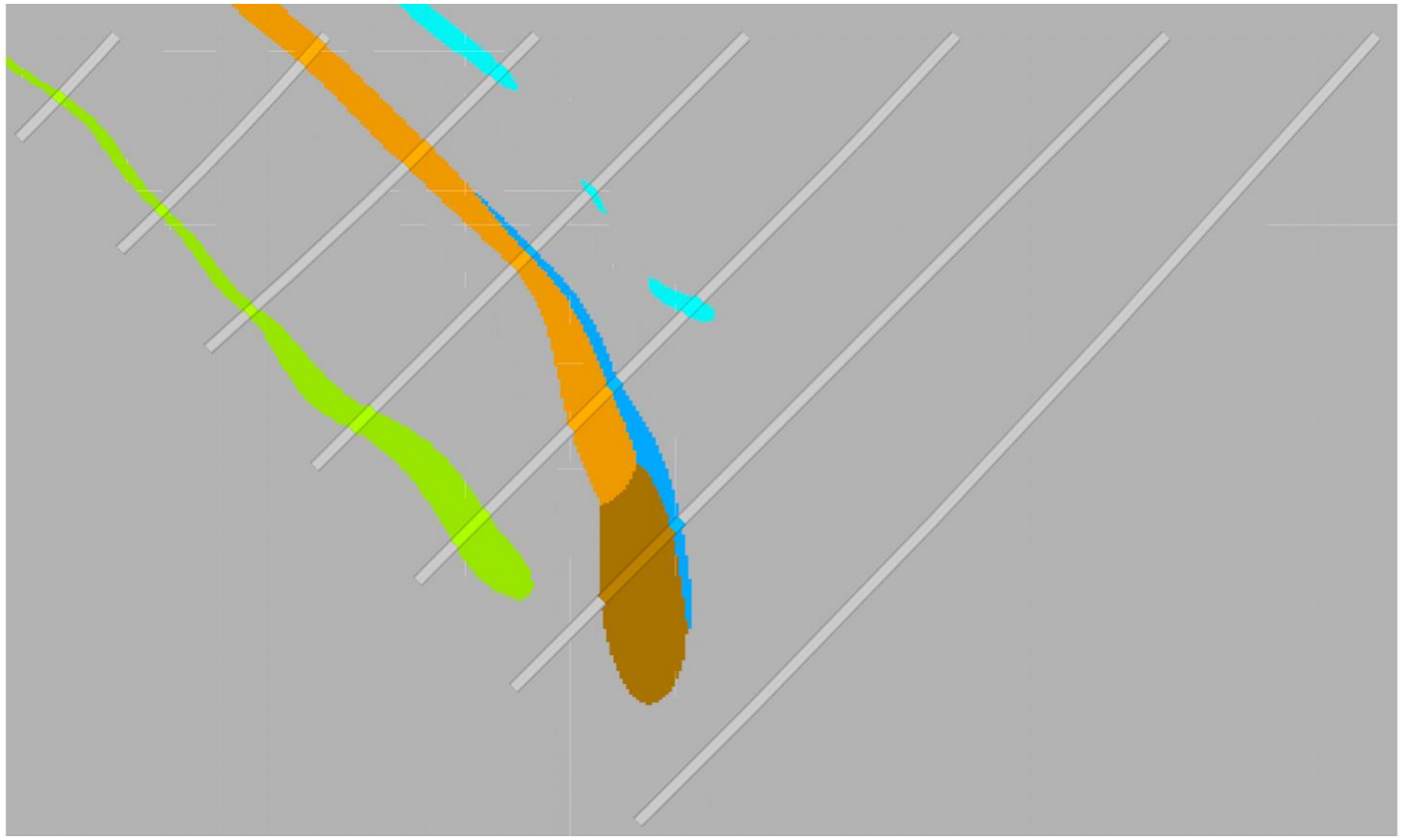


Domains + Lith

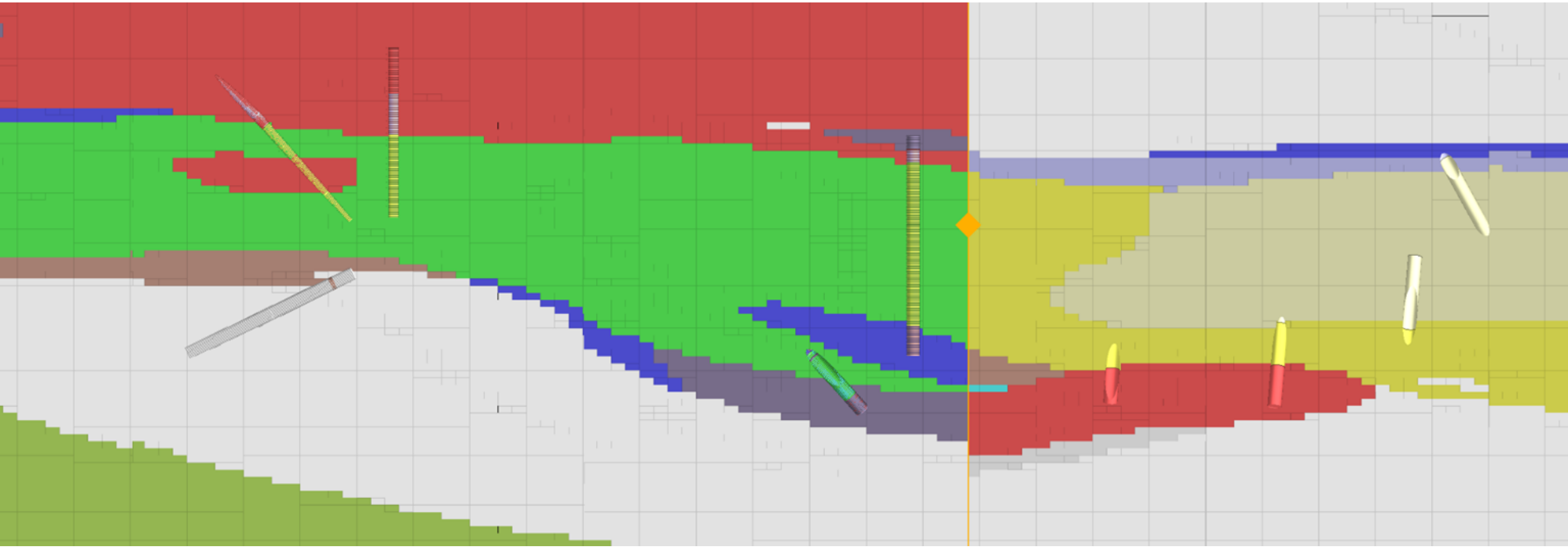
Guided by trends in geological units



- Domains follow geological units where there is strong correlation.
- Domains do not follow other units were there is no correlation.

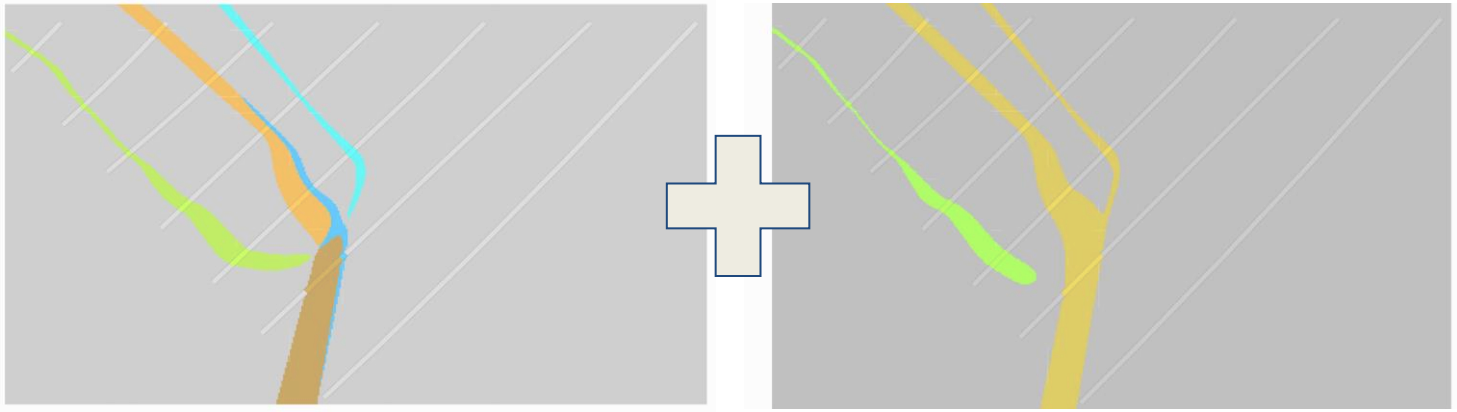


Domains + Lith

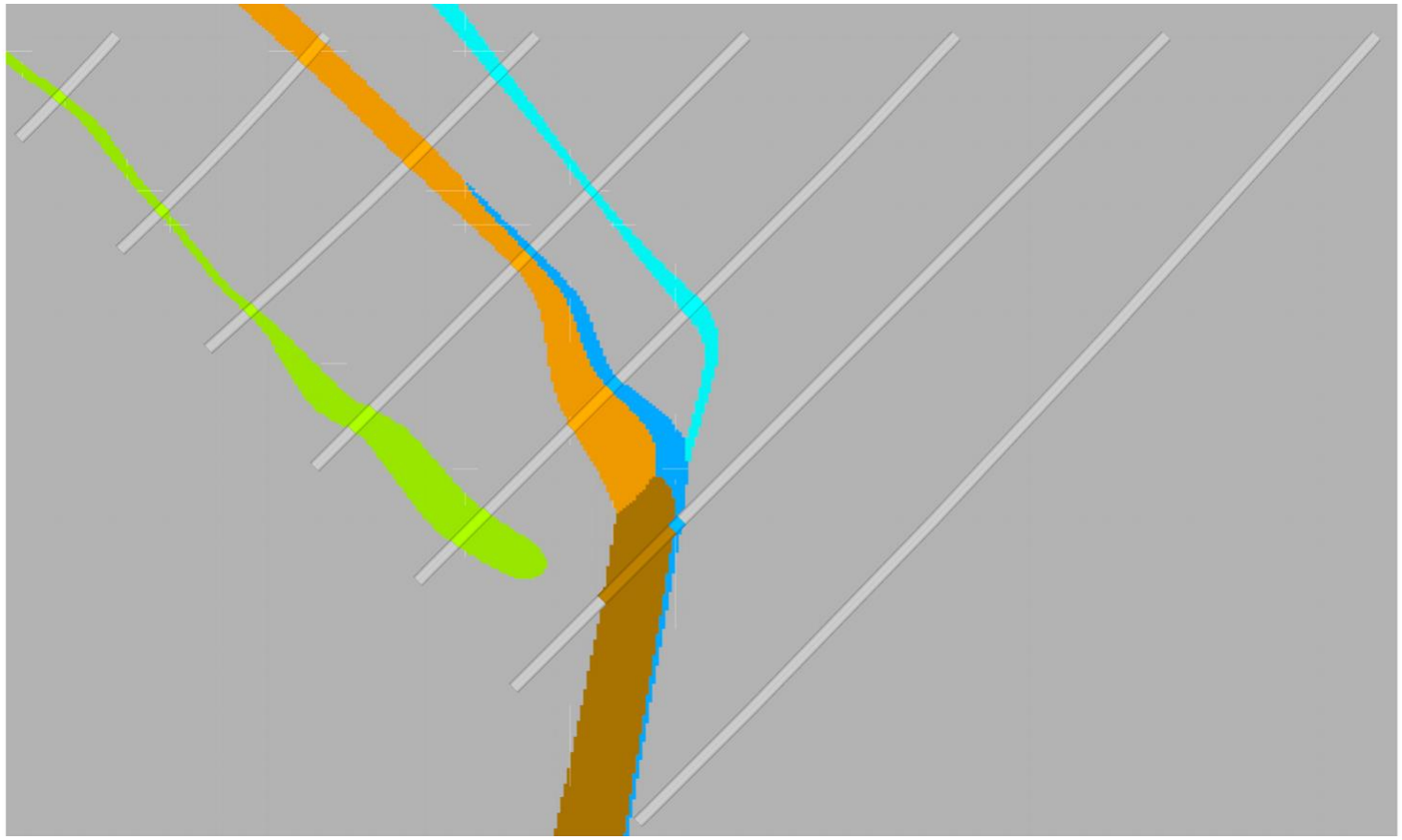


Domains + relationships

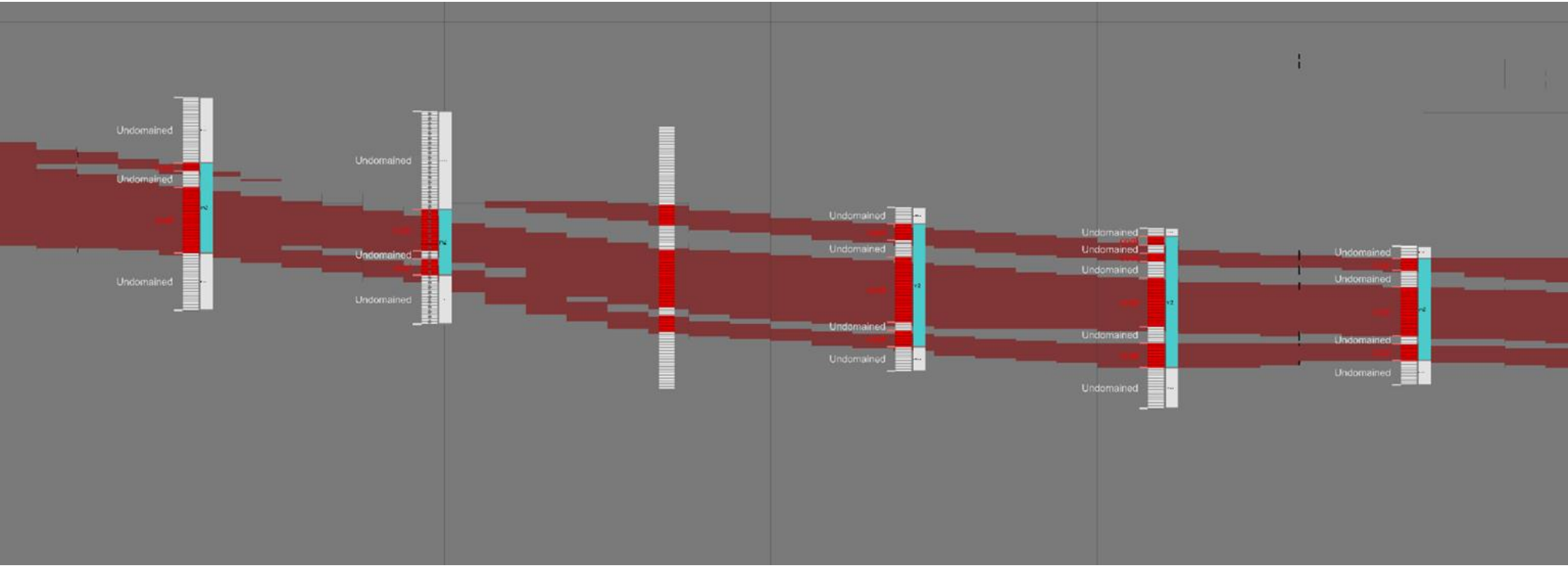
Guided by parent daughter relationships



- Domains merge and split from their expected units.
- Position of units is controlled.

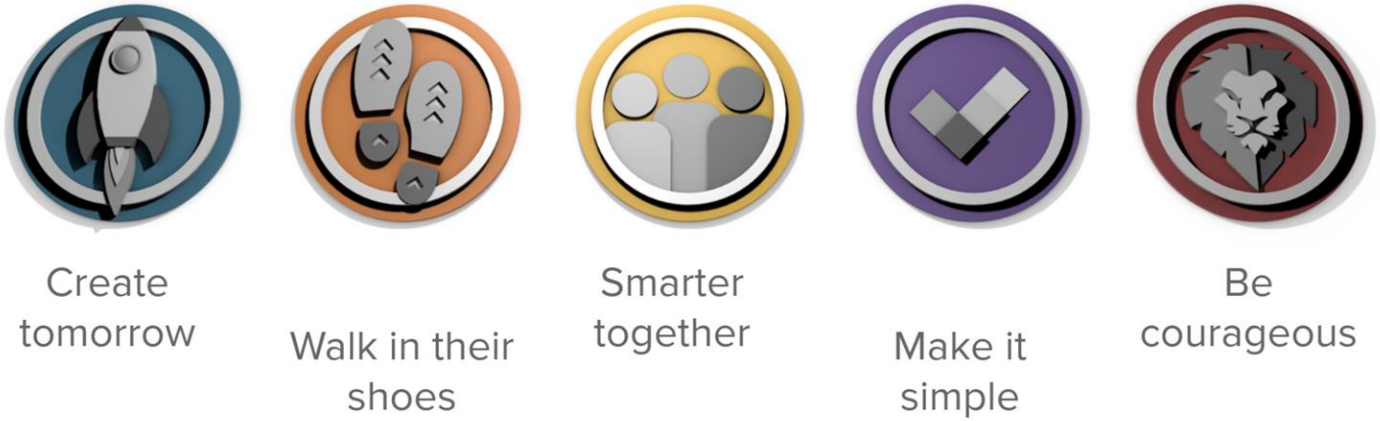


Domains + relationships



Summary

- New technology requires us to think differently.
- A model can be built by adding the same geological controls that define the orebody.
- No explicit definition of the relationships needs to be made.
- Machine learning is not black box, it behaves exactly how you expect by making spatial correlation of the data provided.



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Thank you!