Industry Best Practice for the Collection and Validation of Exploration Data with Particular Reference to a Drilling Program

Rachel McKinney, Database Manager, Coffey Mining

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Introduction

- Reliability and Quality of Data
- Drilling data provides the foundation for any project
- Inherent errors:
    - reduce the confidence in the resource estimation
    - lead to incorrect and expensive decisions
    - affect the potential outcomes
- All codes require a certain level of quantifiable confidence in the data
- If the confidence is low a project cannot progress successfully

Database Validation

- Systematic checks on all aspects of the data
- Remaining errors become irrelevant or the level is quantifiable
- Relational Database lowers risks:
    - Data values can be defined
    - Add further constraints on data
    - relate data held in multiple tables to each other
- Flag issues eg
    - Missing intervals
    - Overlapping intervals
    - Incorrect codes
- Human input error
- Procedures and Protocols
- Non-relational databases

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Process of Data Capture

- Tailored to suit type of exploration, mineral target and orebody
- Training of logging geologist
- Definition of codes and associated meaning
- Data capture of paper logs preferably done by logging geologist
- Data capture done by a data clerk:
- - typing errors
- - number transpositions
- - use of incorrect codes
- - missing essential information
- Recommended to provide data clerk with embedded electronic data sheet and training.
- More rigorous checks and balances should also be applied

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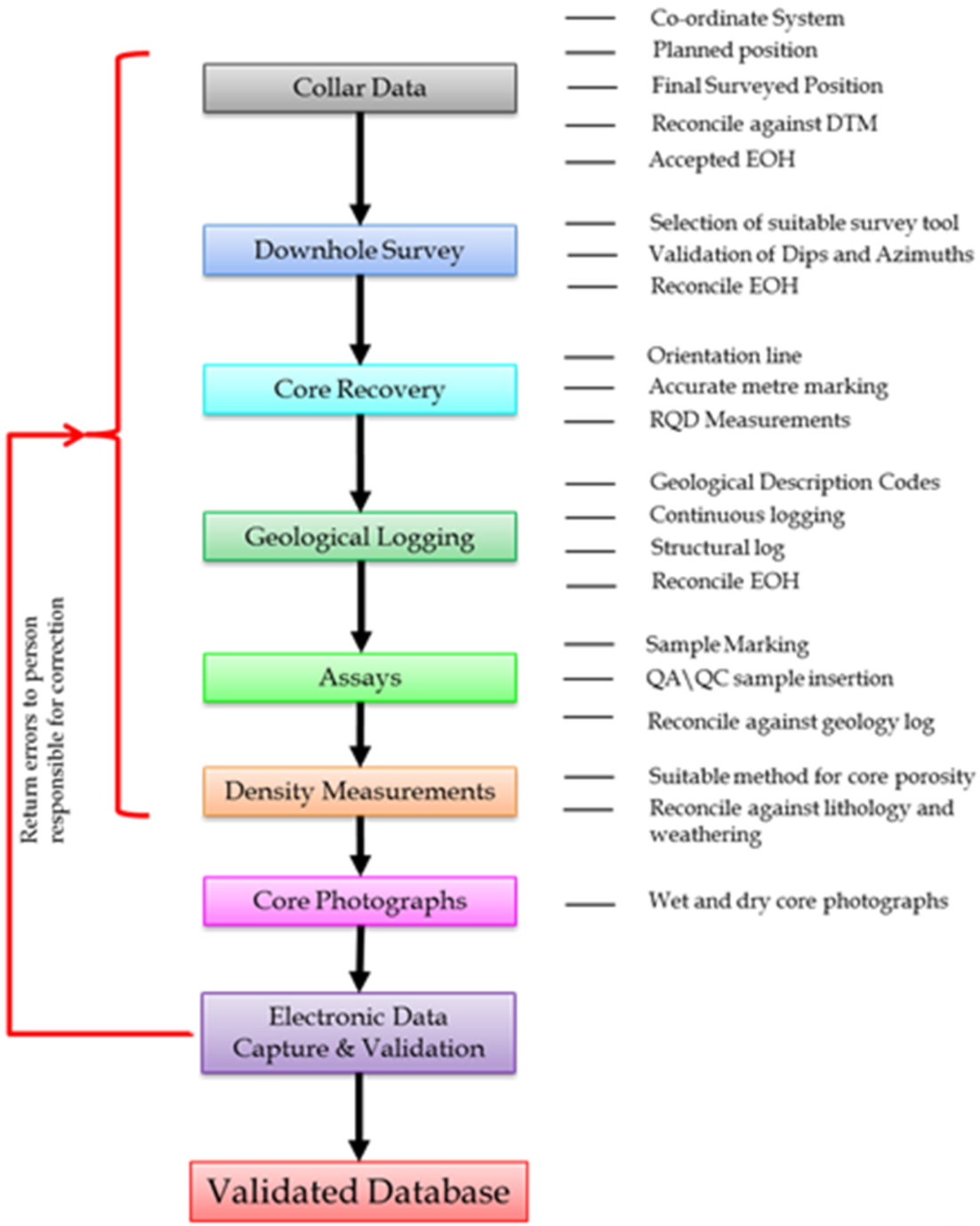
Process of Data Capture cont’d

- Direct logging into electronic format
  - Allows for basic validations to be done immediately
  - Can be set up to accept only certain codes
  - Will not allow entry of obviously incorrect data
- Dedicated Database Manager ensures all required data is compiled, validated and entered into the master database.
- Access to master database should be limited
- Queries or issues reported
- Frequency of validations on the master database

Data Capture Flow Diagram



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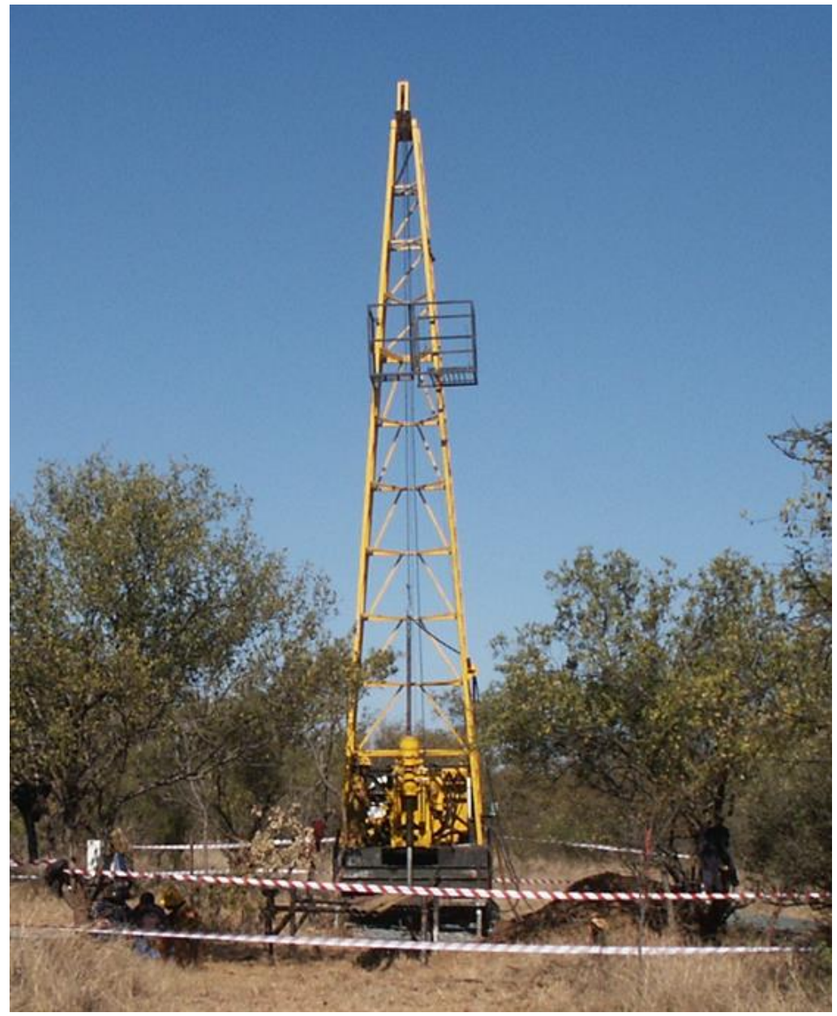
Collar Data

- Collar table should contain both planned and final surveyed position
- Allows planned vs final position to be correlated
- Correlation of collars to a Digital Terrain Model (DTM)
- Confirmation that co-ordinates are in correct geographical and datum system
- Borehole ID names checked to ensure they are identical between data tables e.g. BH0101 not BH101 or BH-101.
- End of Hole



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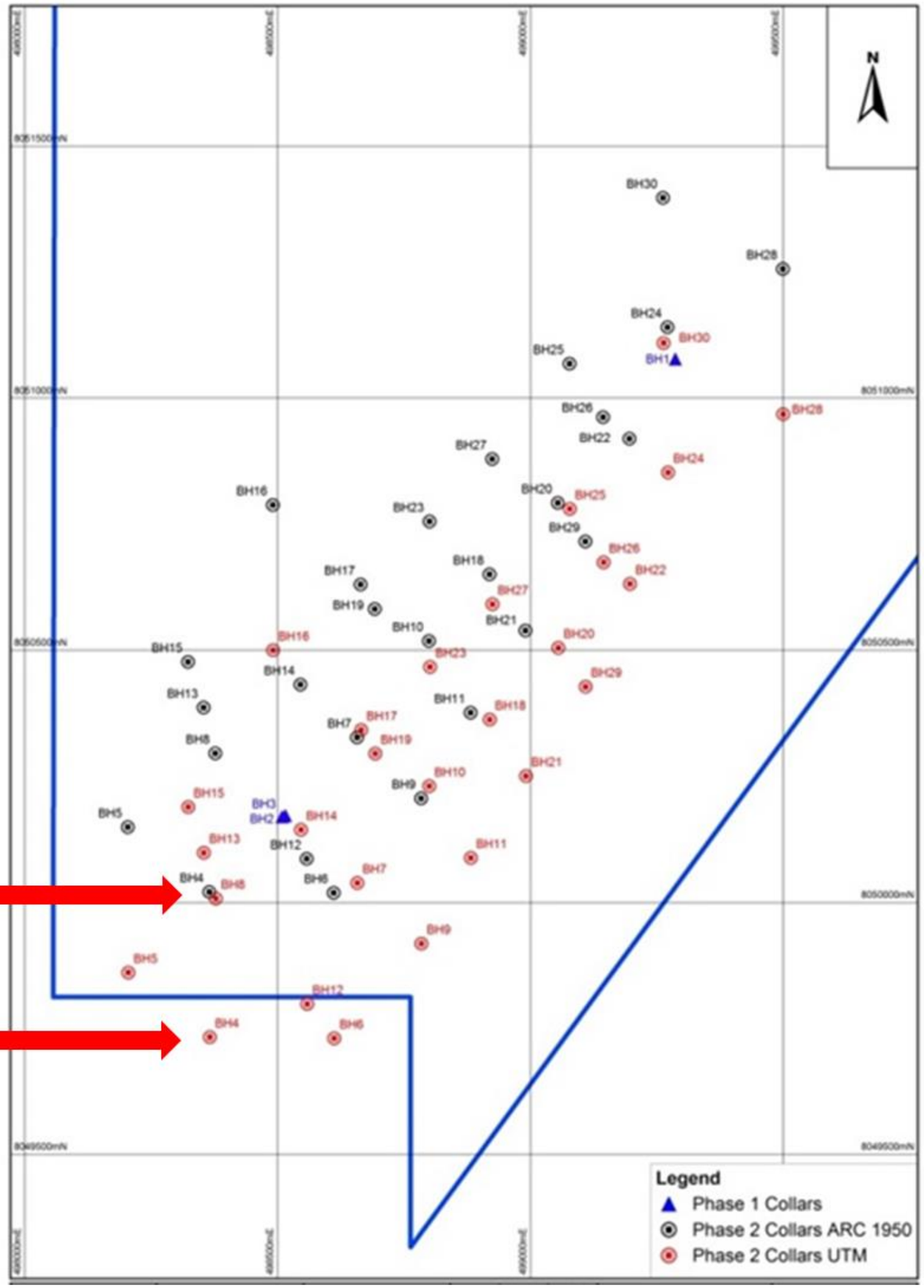
Borehole Plan

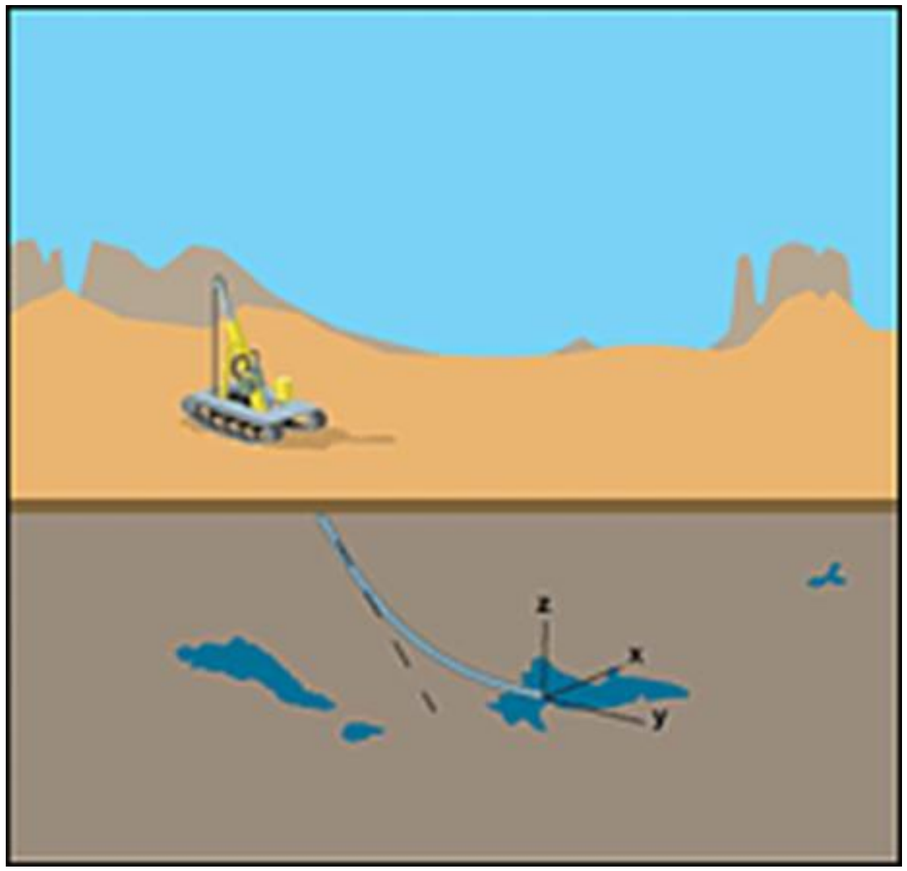


BH14 in ARC 1950

BH14 in UTM

Downhole Survey Data

- Type of tool used
- Dip and Azimuth readings
- Changes in the magnetic field
- Positive and negative dip values
- Sudden changes in the hardness of different stratigraphic units
- Steeply dipping bedding planes



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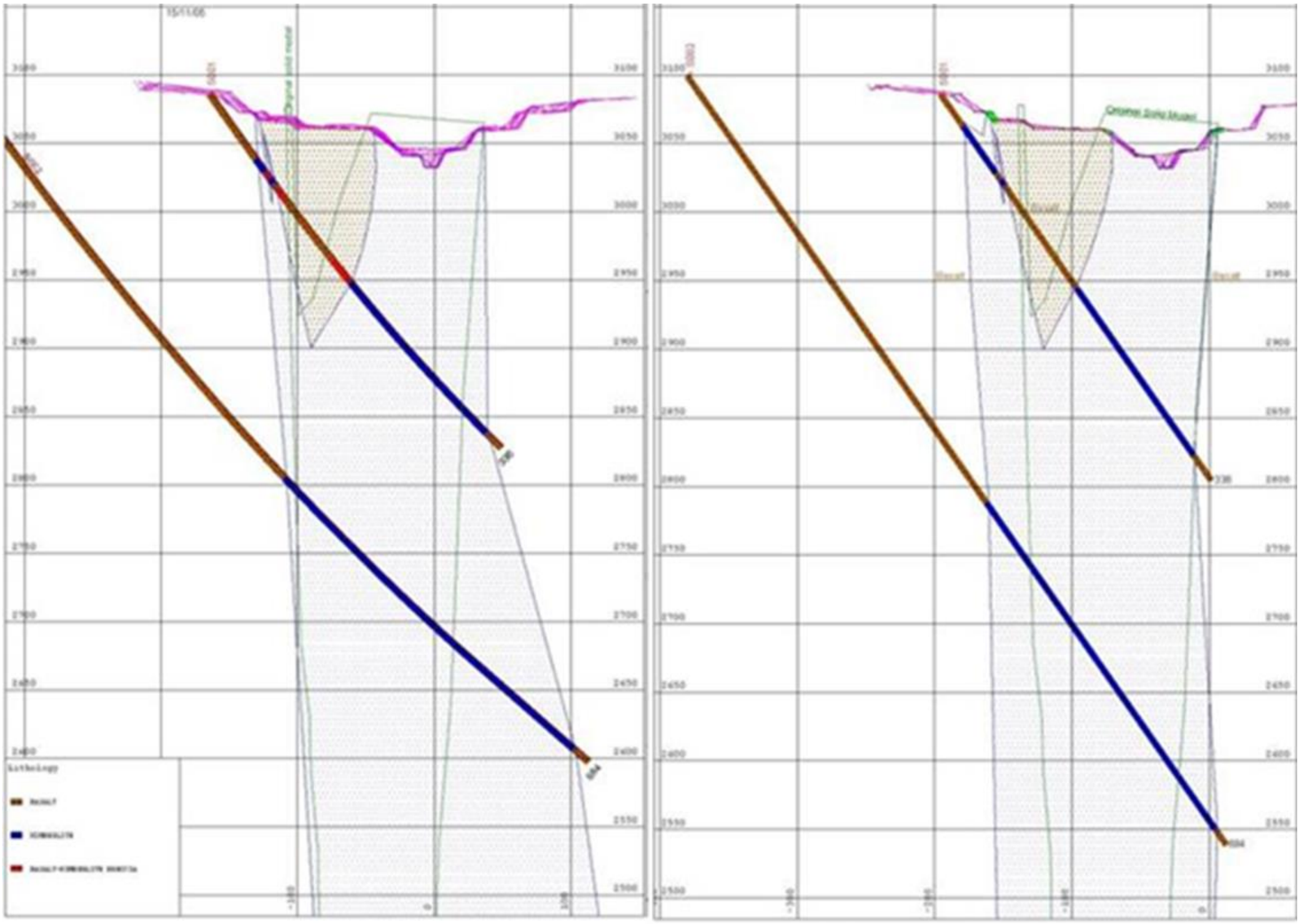
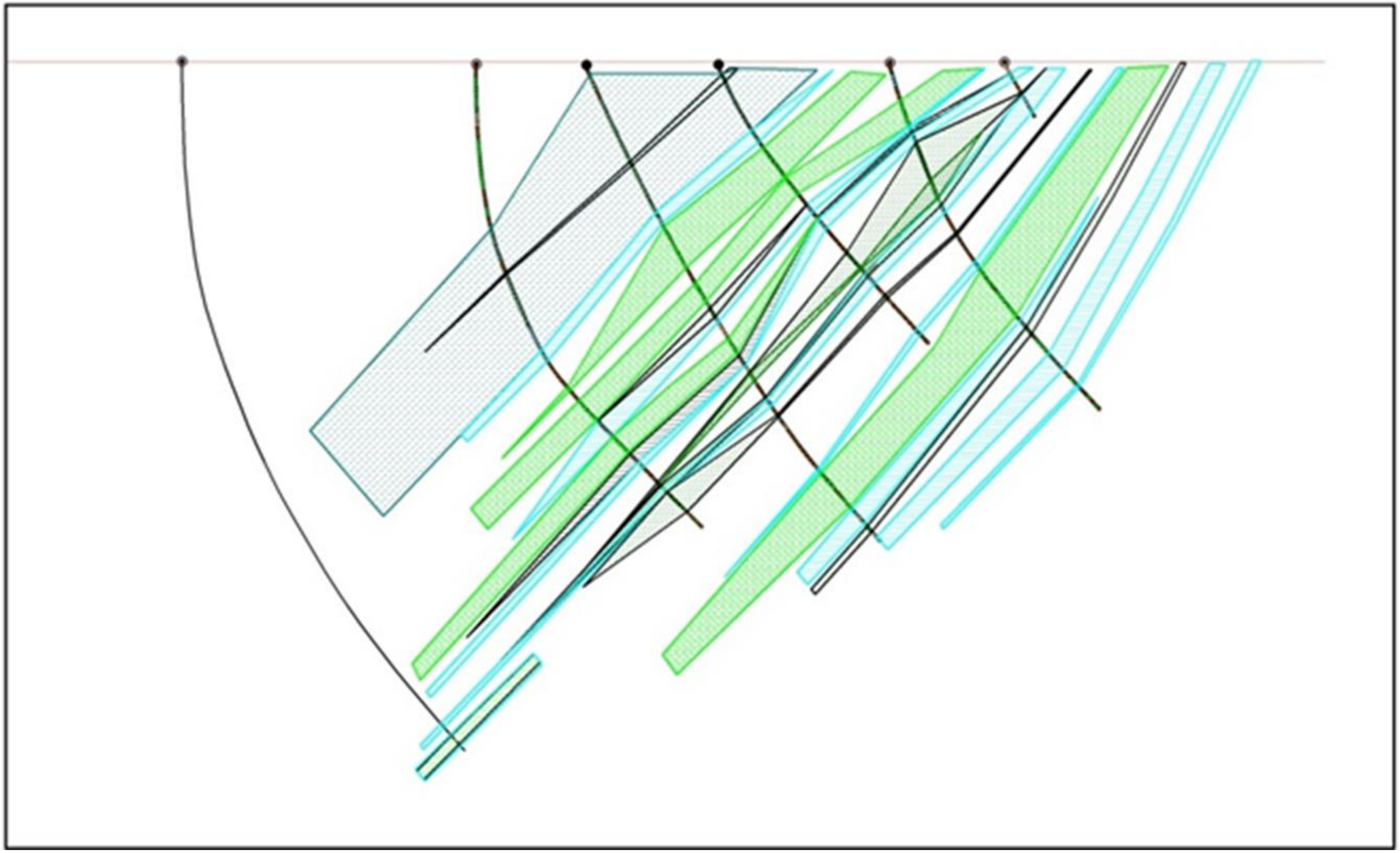
Cross Section Through a Kimberlite Pipe



a. Downhole surveys withfaulty tool

b. Downhole surveys with corrected dips

Cross Section Through Steeply Dipping Strata



Geological Data

- High incidence of errors due to human input
- depth entries
  - number transposition
  - overlapping entries
  - gaps within the sequence
  - inclusion of coreloss
- Codes
  - multiple codes denoting same lithology etc
  - codes with unknown meaning
- Predetermining codes
- Provide loggers with a code reference list or create a rock board
- Confirm code against lithology description
- Hold list of codes in the database
- Use of common abbreviations

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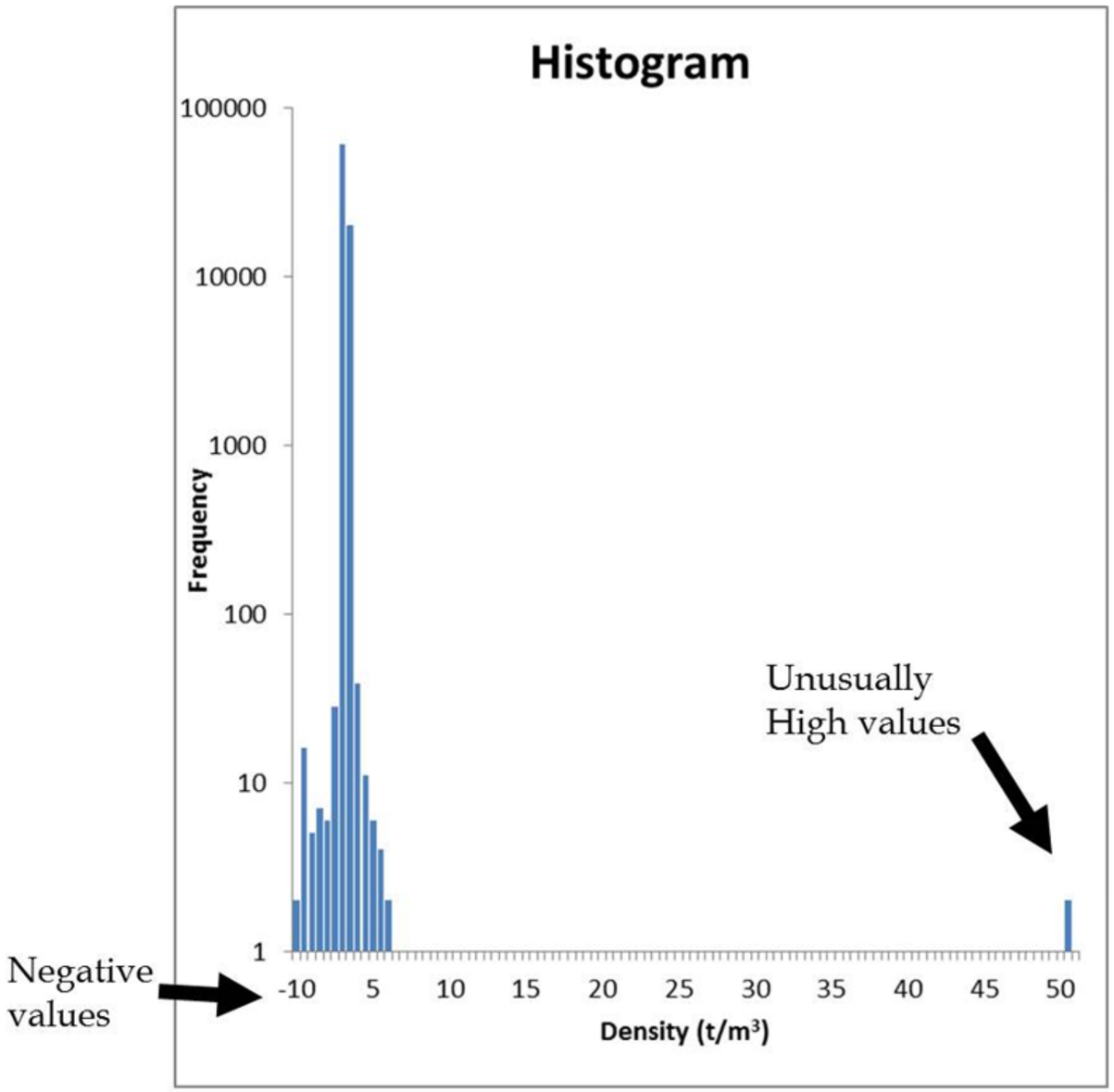
Density Measurements

- Archimedes' method
- Quick and cheap method in the field
- Open to human error input
- Number transposition
- Not fully submerging the sample for the "Wet" measurement
- Most lithologies should fall between 1 and 5 g/cm^3
- Determine acceptable ranges for the lithologies in project area
- Flag all values outside ranges, check and re-measure
- Be wary of weathered samples and use alternate method

Histogram plot of Densities



	Original	Without outliers
Mean	2.89	2.93
Standard Error	0.07	0.00
Median	2.93	2.93
Mode	2.92	2.92
Standard Deviation	19.28	0.12
Sample Variance	371.68	0.01
Kurtosis	65,226.83	22.07
Skewness	- 228.66	- 0.11
Range	7,002.50	4.85
Minimum	- 5,179.00	0.31
Maximum	1,823.50	5.16
Count	81,243	81,210

Assay Data

- Data comes from two sources:
  - Field data e.g. depths, lithology, sample ID
  - Laboratory assay results
- Field data can contain typical input errors
- Sampling protocols are important:
  - What is to be sampled
  - Minimum and maximum sample length
  - Should geological boundaries be adhered to
- Creation of downhole plots as visual validation
  - Geological boundaries are obeyed
  - Sample doesn’t include coreloss
  - Sample lengths not too long or short
  - Assay result matches the lithology

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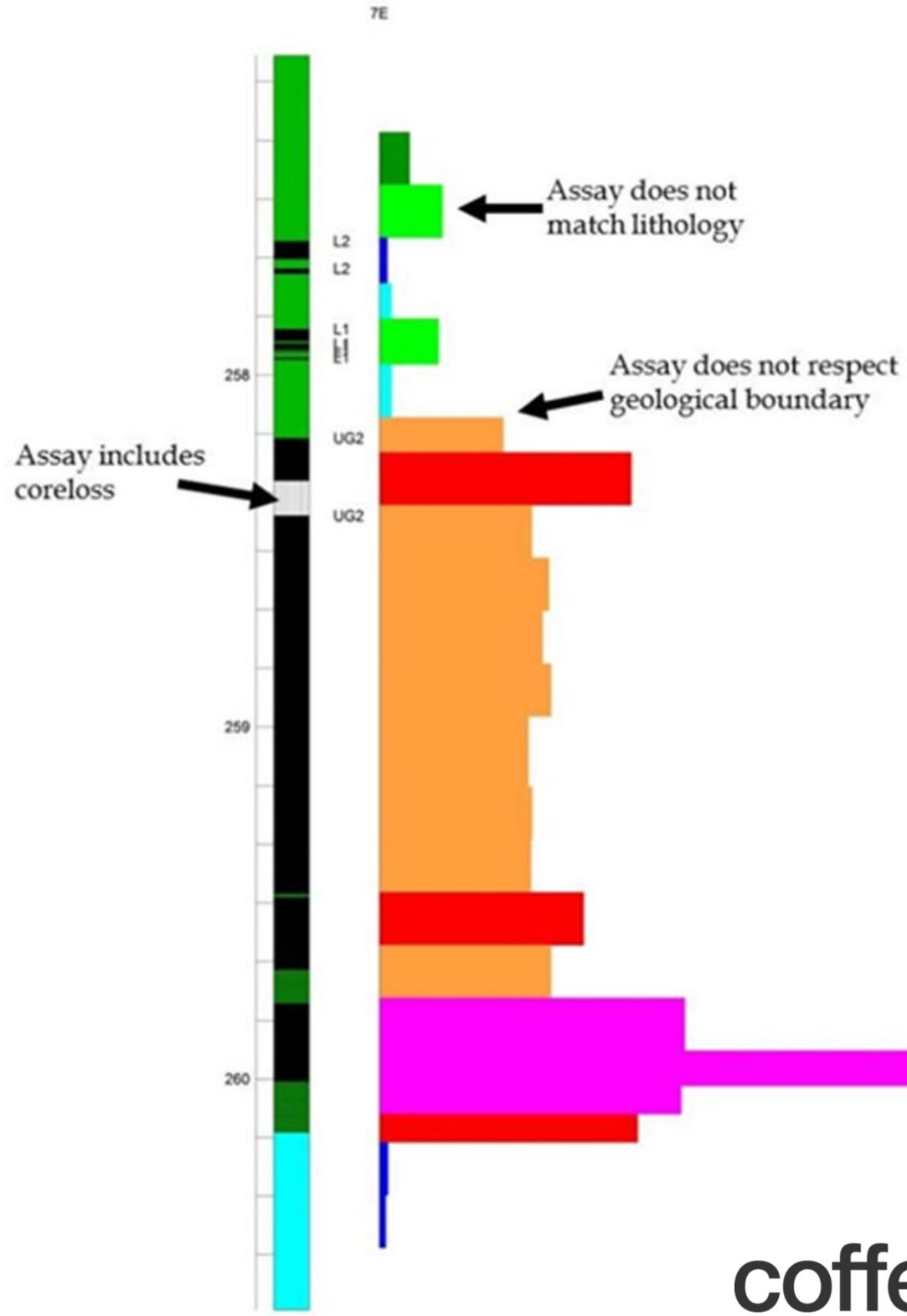
Downhole Plot



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Assay Data cont'd

- Laboratory results often merged into the database
  - sample ID's on assay certificate and in database must match
  - elements assayed not always in same order
  - units of measurement
  - result below detection limit
- Inconsistencies should be queried and re-assays undertaken
- Analytical Quality Assurance\Quality Control
- Regular graphing to detect problems in laboratory methods or protocols
- Potential QA\QC data issues
  - Standard transposed with real sample
  - Different standard has been captured into the database or inserted in the sampling stream
  - Contamination of samples during the preparation process

Conclusion

- Errors and issues should be recorded and corrected in a timeous fashion.
- All hardcopy logs as well as electronic ones should contain corrections for audit purposes.
- The different versions of data should be tracked accurately to ensure the final version is correctly imported into the database.
- Correct storing and archiving of all files is ultimately the responsibility of the Project Geologist.
- Should not rely on the automatic validations of the database software alone but rather in conjunction with these other validation methods.
- Validate regularly throughout the project life cycle.
- Do not leave validations until the end of the project.
- Poor data collection and validation lowers the confidence in the data and the risk to all subsequent work becomes higher.

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