Geological Data Management
The Good, the Bad & the Ugly
Overview

- Introduction
- What’s Data/Database?
- What’s a Good Database?
- Why the Need for a Good One?
- What are the Challenges?

If you don’t design your own life plan, chances are you’ll fall into someone else’s plan - Jim Rohn
Objectives

Our discussions will center on:

- Common Practice
- What is Acceptable Practice

Define your business goals clearly so that others can see them as you do.

-George F. Burns
Some Important Definitions

IGNORANCE
Because What You Don't Know Can Still Hurt You. A Lot.

Did you hear something?
What is a Data

Data is a collection of facts, such as numbers, words, measurements, observations or even just descriptions of things.
What is a Database?

Database is simply a collection of information or a structured collection of data.

- Digital Data
- Hard/Soft Copy Files
- Reports
- Photographs
- GIS Displays
- Petrological Specimens
- Slides
- Rock Samples
- Split Core
- Sample Duplicates

All must be:

**Accurately Stored, Indexed & Accessible for study**

**DBMS:**

Database Management System
acQuire, Datashed, Century, Access etc
What is a Good Database

Quality of a Database/DBMS is measured in:

- **Accuracy** - True, Facts
- **Availability** – Timely Accessibility
- **Security** – Confidential / Safe
- **Usability** – Fit for Purpose
- **Resilience** – Long Lasting

“Quality database means the data has been generated with proper procedures, been accurately transcribed from the original source and is suitable for its intended purpose”
Why a Good Database?

The Most Valuable Corporate Asset

Resource/reserve estimates, production plans etc, are only as dependable as the information upon which they are built

“Always remember that money does not buy happiness. But be sure to accumulate sufficiently enough before thinking or saying such nonsense”

- Malcom Forbes-
The Pearl Harbour Example

A Pearl Harbour: where it was done wrong with almost disastrous consequences
BP Minerals Canada, Chetwynd (Hope Brook) Deposit in Newfoundland

- Low grade gold deposit found during Ni search
- All drill assays done by same lab
- Lots of duplicates
- No SRMs, lab does its own SRM checks, so no need (who knows what an SRM stands for?)
- Bulk sample for met testing from closely drilled area
- Met lab head grade 10% lower than drill indications
- If true, deposit marginal. Panic!!
- Third lab called in to test Lab 1’s drill assays
- Lab 3 gets 5% MORE Au than lab 1.
- Who is right? Is anyone right?
- Economics of whole project in serious doubt
Cry goes out for SRMs to all BP Minerals companies
Round Robin done on all 3 labs
Turns out lab 1 was correct all along
Mine developed, never made much money but head grade was always very close to prediction (would have been better if lab 3 had been right!)

Only way to test ACCURACY is by use of Standard Reference Materials (SRMs) of clearly pre-defined Au/Cu etc. content
All labs can and will, from time to time, get it wrong
Our job is minimise the times those mistakes get through into our data bases.
Possible consequences
- Ore to waste heap
- Waste into mill
- Mine a dud
- Leave a plum in the ground for someone else to mine

(The Pearl Harbour Example)

Culture eats strategy for breakfast
### More Examples

#### JORC/SOX Statutory Requirement

**The Enron Scandal (2001)**: Earnings and assets were falsified to have balance sheet portray a favorable depiction of its performance. Enron's stock price, which hit a high of US$90 per share in mid-2000, caused shareholders to lose nearly $11 billion when it plummeted to less than $1 by the end of November 2001.

**SOX Act of 2002** on 23rd January. The act was to protect investors by improving the accuracy and reliability of corporate disclosures.

**Bre-X’s Scandal (1997)**: Gold reserves were alleged to be 200 million ounces; 8% of the entire world’s gold reserves at the time. There was no gold. Core samples had been faked by salting them with outside gold.

The **NI 43-101** was created after the Bre-X’s Scandal to protect investors from unsubstantiated mineral project disclosures.

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*Experience is a the best but hard teacher; she gives tests first, then lessons afterwards.*

- W Saroyan-
1.1% Cu; 1.76 g/t Au

Mineral Asset Mgt.

ASSET MINING
Reserve definition Dev.
Route Determination
Blast Design
Slope Stability Monitoring
Environmental Compliance

ASSET DEVELOPMENT
Resource Definition Dev.
Pit Analysis and Optimization
Rock Properties/Recoveries
Volume Tonnage Analysis

ASSET DISCOVERY
Anomaly Assessment
Resource Determination
Geological Confirmation

MINING MANAGEMENT PROCESSING & ANALYSIS
Geological Information Management
Geological Observation and Measurement
Met Geotech Near Mine Grade Cont. D&B Environmental

RESOURCE DEVELOPMENT PROCESSING & ANALYSIS
Geological Information Management
Geological Observation and Measurement
Infill Geotech Met Density Environmental

DISCOVERY PROCESSING & ANALYSIS
Geophysical Information Mgt.
Geophysical Observation & Measurement
Geological Information Mgt.
Geological Observation & Measurement
GIS

Data Information Interpretation

Geochem RAB+RC Diamond

(Stolen from acQuire 😊)
A sample is a subset containing the characteristics of a larger population. Samples are used in statistical testing when population sizes are too large for the test to include all possible members or observations. A sample should represent the whole population and not reflect bias toward a specific attribute.

In order words a sample is a smaller, manageable version of a larger group. **Sampling** is therefore the act of “taking a portion” by a defined procedure.

The catch is that it should be “randomly selected to represent the behavior and characteristics of the entire group.”
What is **Quality Control (QC)?**

**Quality Control**
A system or process for verifying & maintaining a desired level of quality of data (during the collection, transcription, storage and retrieval of the data) by **careful planning, use of proper equipment, continued inspection, and corrective action** as required!!

**Quality Assurance**
A system for ensuring (confirming, guaranteeing, warranting) a desired level of quality in the generation/collection, storage & retrieval of data. It is therefore a combination of **Quality Control and Quality Assessment** (determining the level of quality).

Effective quality systems contributes enormously to the success of projects. When poorly understood, are likely to be weak and ineffective in ensuring that data is delivered on time, within allocated budget & satisfies the needed requirements.
Quality Control

**QC when Planning**
Plan to drill & retrieve samples in a manner that will deliver the desired level of quality – Example take into consideration the ground condition vs. core recovery.

**QC on the Rig**
Drilling is simply sampling - precision/representativeness is paramount
- Hole numbering
- Location of hole/rig set up – Dip & Azi
- General housekeeping
- Core retrieval
- Cleaning and packing (boxing) of drill core
- Core run blocks and core box labelling
- Core orientation & marks
- Monitoring hole deviation where DHS are taken
Correct Azimuth (to mine grid)
Instrument error? – Check mag readings.
Remove kinks only – don’t correct DHS data!!
A Cu/Au/Ag mining company, grade is king
We can ONLY determine grade with good quality assays
You could say “Assaying is what you do – it is the core business”

In this environment, we take lots of samples, so does QC really matter?
The answer is YES!!
Your data are subject to the French legal system, guilty till proven innocent!

If your assay data are not “CORRECT”, you will NOT be successful.
You have to KNOW they are correct, and tell management so.
Therefore our priorities for assay work MUST be:

1. Quality
2. Quality
3. Quality
4. Price and turnaround

There are three essential elements to QC. They are, and must remain part of the Geology & Exploration CULTURE

These are:
1. You must do it
2. You must evaluate the data
3. You must react when things appear to be wrong
Some definitions:-

- **ACCURACY**: how close a value is to the “true” value for that sample. Standards. Blanks

- **PRECISION**: how repeatable the value is regardless of accuracy. Duplicates.

- **DATA FIT FOR PURPOSE**: with reference to concentration level and sampling type/interval.

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Low Precision & Low Accuracy

Not much good!

High Precision & Low Accuracy

Can be OK say for soils

High Precision & High Accuracy

Ideal. Essential for evaluation
Sampling & Analytical QAQC?

- **Standards** *(matrix should much with deposit type, grade range should be similar to that of the deposit)* are inserted with all assay subsamples to determine the accuracy of the assaying at the Lab.

- **Blanks** *(zero grade, hard enough, indistinguishable from primary samples)* are inserted with all assay subsamples to detect possible contamination at the Lab.

- Grind checks are performed on the crushed and pulp samples to determine if the sample preparation at the Lab is adequate.

- **Check assays** *(pulp duplicates)* are sent to an Umpire (referee) Lab to determine whether there is assay bias at the Primary Lab.

- **Check samples** *(coarse duplicate samples)* are taken to determine if the primary assay subsample delivered to the Lab is representative of the original sample.

The price of greatness is responsibility.

-W Churchill-
Sampling & Analytical QAQC?

Insertion of QC Data

- Not less than 5% QC samples in all jobs
- At least 5% standards/blank to monitor accuracy/contamination
- 5% duplicates (check assays & check samples) to monitor precision
- 10% of the drill project, target etc. umpire checked with check assays to monitor bias on quarterly basis
- Have to budget for this, it’s not free
- We will use but cannot simply rely on lab’s in-house QC

"Efficiency is doing things right; effectiveness is doing the right things."
- Peter Drucker
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**Back to Lab for re-assay if QC fails**

Or click **"Execute Now"**

**Import object; To load or not to load?**

**QC Plot for STDs before import**

**Source file**

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**QAQC on import...**
Somewhere in West Africa

QC Samples insertion: Every sample ID ending –
in “5” = Dup,
in “0” = STD of Blank
No QC assessment or reporting…..
Somewhere in East Africa

Missing Samples – Sample theft!!
Strange Assay Values - high grade zones returning ####
Somewhere in West Africa

- Damaged Parts of the Splitter
- Gap between Splitter Openings and Receiver Bins
- Gap between Receiver Bins

Worn-out Riffle Splitter

Improper Splitter Setup
Somewhere in West Africa
Somewhere in West Africa
Proper Splitter Configuration

- Flanges below the openings which enable the divided material (50% to each side) to fall into one of the two receiver trays/bins that are orientated length-wise and back up to the centre line of the riffle, and are each large enough to contain the split material (50% of the original sample material) without cross-contamination between the individual trays.

- The flow of sample material onto the top of the splitter slots (A) should take place in an even, smooth flow over the entire length of the splitting device.

- The sides of the top of the riffle splitter (B) need to be of such height that there will be no spillage of sample material and all sample material will pass through the splitter slots.

- The side of the receiving bins (C) are of such height that no sample material is lost due to spillage from these bins during splitting.

- There is no chance of cross-contamination of split sample material at the bottom of the splitter slots (D) because the end-plates (flanges) at the bottom of the splitter slot openings are of sufficient length to avoid this cross-contamination.
Proper Splitter Configuration

- A feeding chute (hopper) or material feeding platform in which, or onto which, the total sample is deposited.
- An even number (16 – 32) of opposed angled slots.
- The opening (slot) sizes are equal and have magnitude of at least 2 to 3 times the size of the largest particle in the material that is to be split.
- The width of the slot remains the same down the entire length of each slot (no slots with, for example, narrow ends).
The Desert of West Africa
The Desert of West Africa
The Desert of West Africa
The Desert of West Africa

Core Sampling
The Wettest Corner on the Planet
Disposal of ~70Km of drilled core samples which had decomposed due to weather resulting in the loss of ~34M AUD worth of some recent and historic reference data in the form of core samples.

The value of the lost data (beyond monetary value) cannot be quantified as mined out portions of the property cannot be re-drilled for further studies etc.
### Challenges and Solutions

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scarcity of funds</td>
<td>Attempts to save money in data management should be avoided as much as possible</td>
</tr>
<tr>
<td>Lack of qualified expertise</td>
<td>Training of Geo staff is important to ensure database is of optimal reliability</td>
</tr>
<tr>
<td>Inadequate supervision</td>
<td>Project managers must have overall responsibility for the quality of data</td>
</tr>
<tr>
<td>Inadequate Planning</td>
<td>Planning for a quality database is very important</td>
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</table>
The good is cool. The bad will be shot (survivors will be shot again!). The ugly shall be hanged – By R Addo 😊.