Geoscience Data Management: Key to Successful Decision-Making in the mining and oil & gas industry

by Benedikt Steiner - August 1, 2016

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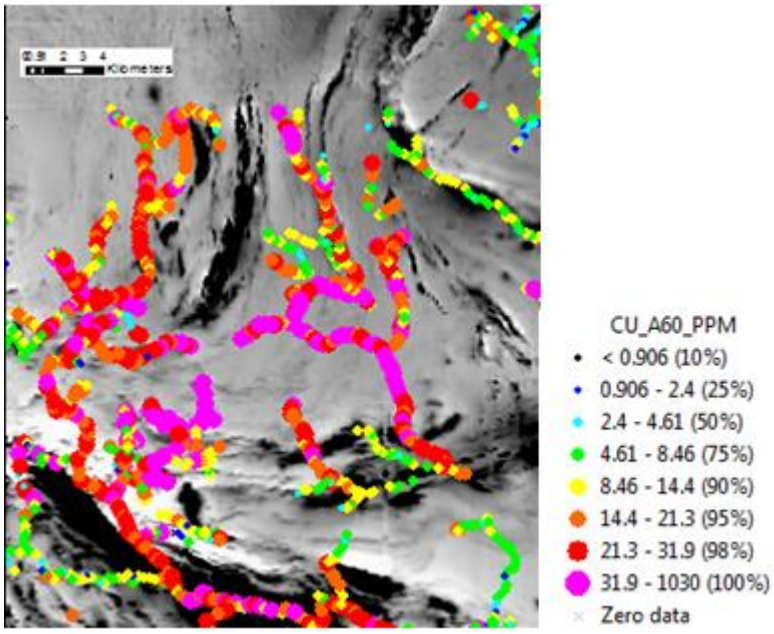
Last week a geologist running a greenfields project asked me about ways to improve data management workflows, and more specifically, how to develop new database solutions moving away from using simple excel sheets or GIS shapefiles. Since I have had similar discussions in the past, I thought it would be time to review the development of exploration data management practices.

What particular geoscience data are we concerned about?
Spatial data management is critical to all economic decision-making processes in the mining industry and public geoscience organisations.

Geoscientific exploration data comprise a number of data sources and formats. Exploration geoscientists routinely collect geological, geophysical, geochemical, drillhole and GIS data along with reports and other written material. The data format ranges from simple excel spreadsheets to large ASCII or .las geophysical data, GIS shapefiles, maps and pdf files. The challenges geoscientists and data managers are faced with is to integrate a wealth of spatially-referenced geoscientific datasets in a storage solution that allows easy access from a variety of locations, simultaneous editing, output and download of data exports and other products (e.g. strip logs, QAQC workflows).



Example: Stream sediment assays overlying a magnetic survey in Finnish Lapland (GTK base data)

Historical data represents a very useful information source, often hidden away in governmental archives for decades. Therefore, legacy data can be seen as a treasure box containing substantial information that, in combination with proprietary datasets, may increase chances of discovery. The data format usually consists of hardcopies that require scanning and subsequently georeferencing before spatial and attribute information can be extracted. This is often a complicated and time-consuming process and presents geoscientists with a struggle. For this reason historical data usually remains unorganised and just "dumped" on internal servers with no accompanying information and metadata, which in turn makes data mining and knowledge extraction a challenge later on.

Developments in data management practices

On the positive side, the quality of exploration data has continuously improved over the last decades, a development which is underpinned by the availability of mobile electronic devices and the introduction of improved data management systems capable to collect, store, share and manipulate different geoscientific datasets in real-time. An example is the ArcGIS online solution provided by ESRI or the DAP server operated by Geosoft. However, prevailing concerns are system, database and maintenance costs, time and resources to manage databases as well as the complexity of producing downloadable and useable outputs.

Whilst in the early 2000s it was common to collect field data in spreadsheets or hardcopy sample cards, mobile GIS solutions now allow field teams to use mobile appliances and streamline their sampling procedures in the field. The storage and sharing aspect of the workflow outlined above is commonly taken over by data manager roles within larger organisations, whilst geoscientists might find it difficult to operate complex database solutions.

A varying maturity of data management protocols and solutions is observed in the industry. The majority of companies to date utilise simple and cost-effective data management methods and workflows, such as MS Excel and Access. This guarantees a fast collection of data that are later fed into relevant software packages, such as OasisMontaj, ArcGIS, Leapfrog and other modelling packages. However, data collection using MS products and GIS shapefiles does limit the effective storage and manipulation of large, diversified and multiple-stage work programmes, especially if limited data validation and QAQC tools are available. Similarly to what has been said about historic data, a simple, centralised server file and storage system is operated with the disadvantage that data "dumping" often creates confusion, duplication and unnecessary mixing of data.

Larger companies therefore tend to develop proprietary solutions or invest in specialised database software, e.g. AcQuire, that is tailored to the needs of effective data storage and manipulation.

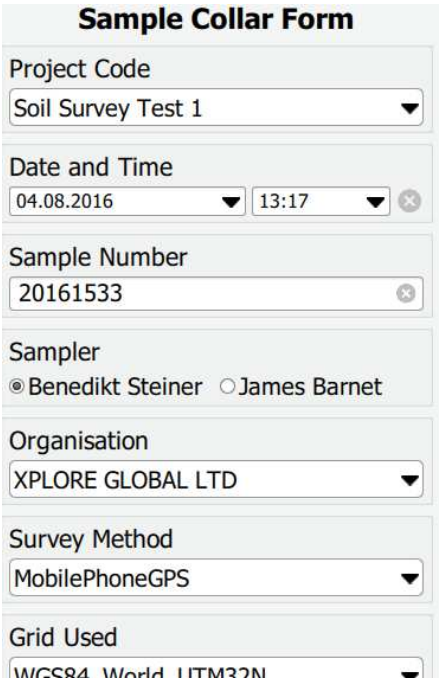
Mobile GIS/ GNSS technology

To date, field surveys heavily depend on the traditional use of handheld GPS, sample cards and excel spreadsheets. The data management process is consequently prone to errors during the transfer from hand-written sample cards to excel sheets and subsequently GIS

applications. However, it is not uncommon anymore to see geoscientists in the field with Trimble and cell phones collecting data.

Field technician collecting data on a Trimble device during a routine soil sampling campaign.

The last 10 years have seen a rapid development of mobile GIS/ GNSS technology and improvement of workflows in the field. This resulted in more efficient ways of collecting samples or mapping data. Mobile GIS or other apps (ESRI Collector, Navigator etc.) make it possible and worthwhile to take other geoscientific data (geophysics, remote sensing) into the field and have multiple users working in different geographic areas. For example, during a routine field mapping programme, a geologist can cross-check his mapping outcomes with magnetic or radiometric data layers whilst collecting samples that are later uploaded and shared with team members.



Mobile Data collection: *XPLORE GLOBAL LTD. developed an easy-to-use smartphone sampling solution based on ArcGIS online apps.*

Current and future requirements

A list of current and future requirements for database and data management was compiled following a recent published survey by Geosoft (Randall and Green, 2016) and the author's personal experiences:

- Consistent data management workflows within organisations, e.g. a shift away from using simple excel sheets and shapefiles to more sophisticated geodatabases and online dataserver systems
- Real-time collaboration between multiple users on the same project and improved versioning
- Access to datasets in easily downloadable formats capable to be used between different software and hardware setups
- Cloud and server-based secure data management solutions,
- Reduced costs of data management systems over time,
- Geologists to be owners of geological data again,
- Mobile GIS applications allowing a rapid and efficient access to data collection, processing and presentation in the field.

How can XPLORE.GLOBAL help you in improving your data management workflows?

Our extensive experience in working on a multitude of mineral exploration and mining projects in different parts of the world allows us to provide you with a tailored data management service. We have spent many years in the field and know what is required to provide economic, yet practical, data management systems under often remote conditions with limited communications. We offer:

- Review of existing data management structures and strategies
- Setup of data management plans and related documentation
- Implementation of effective and efficient data management systems tailored to the client's corporate structure and organisational requirements
- Development of geoscientific databases
- QAQC of assay data to international best practice standards
- Provision of cloud/ server-based data storage systems through GIS-focused subcontractors
- Mobile GIS solutions using GNSS systems and data capture software through GIS-focused subcontractors
- In-house or field-based training in all aspects of database setup and maintenance, data collection and storage and mobile GIS applications