Leading partner

Photogeochemistry unlocks significant value through combination of ioGAS and Datarock

Case Study

Challenges

Geochemistry and core imagery are commonly collected by resource companies from their drilling operations. However, resource companies struggle to integrate these different data sets to build a quantitative understanding on the geology.

Geochemistry can be interpreted alongside core imagery data to provide a much more cohesive geological context.

IMDEX Solution

The Datarock Platform is designed to transform raw core photography into analytics-ready data. ioGAS is IMDEX's geoscience data visualisation software specialised for exploratory data analysis on specifically geochemistry data.

IMDEX and Datarock demonstrate how both platforms can be combined to unlock significant value, creating supervised and unsupervised models that convert images from something to be viewed into something that can be numerically analysed alongside geochemistry and other contextual geology data in ioGAS.

Project Details

Data for this analysis came from the Geological Survey of South Australia's Mineral Systems Drilling Project (MSDP) in the Gawler Range Volcanics, and focused on a single drill hole MSDP04.

The MSDP was a collaborative initiative managed by the Geological Survey of South Australia (GSSA) to refine geological models and identify mineralisation controls in a challenging terrain where exploration models had not been established.

Exploring imagery data from Datarock in ioGAS

The Datarock Platform creates several different types of data from raw core photography including simple RGB dominant colours, image descriptive features, geotechnical and geological datasets.

For this study, a basic set of outputs was used.

Colour

The Datarock Dominant Colour product condenses the varied colours represented in a core image to consistently determine the dominant colour of each row of the core.

It is very useful as an ancillary dataset when viewing geochemistry and other image features and is used in several plots in this analysis.

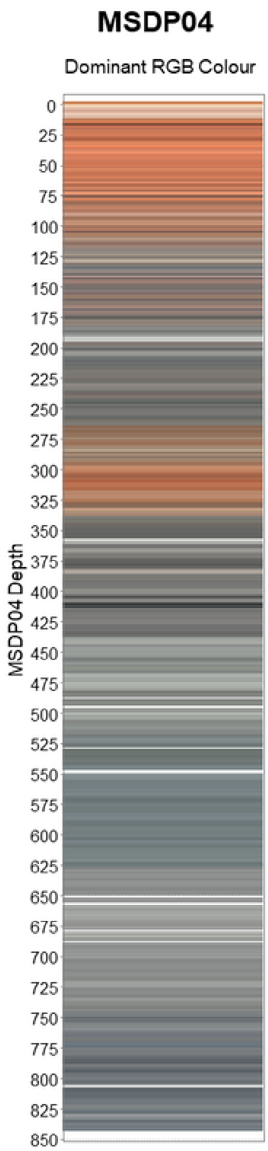

Figure 1. Dominant RGB colour from each cropped and depth registered row of core photography from MSDP04. White areas represent imagery gaps.

Unsupervised analysis

The Datarock Platform is able to generate descriptive features (variables) that do an excellent job in numerically describing the colour, texture and overall appearance of a rock image.

In this example we have used these features to do some unsupervised image clustering to understand geological domains present within the imagery.

Note that the unsupervised clusters were generated on multiple variables derived from the imagery.

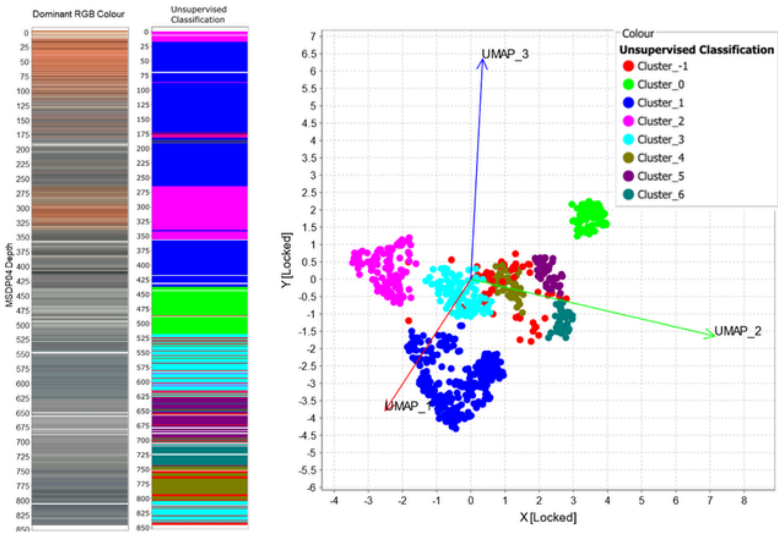

Figure 2. MSDP04 downhole plots with (left) Dominant RGB colour (right) DBScan cluster colours (red -1 represents outlier points). 3D UMAP of image features coloured by DBScan clusters.

Supervised analysis

A supervised lithology classification model was constructed in the Datarock Platform by building a training dataset of around 500 5cm x 5cm images for each lithology.

This model was trained from imagery taken across the entire MSDP set of drill holes and predicted onto MSDP04, with the resultant simplified lithology model shown on the right.

Using imagery only, most of the main lithology boundaries in MSDP04 are identified, but there is some confusion in the bottom half of the hole where the imagery contains some non geological variation (shadows, reflections etc).

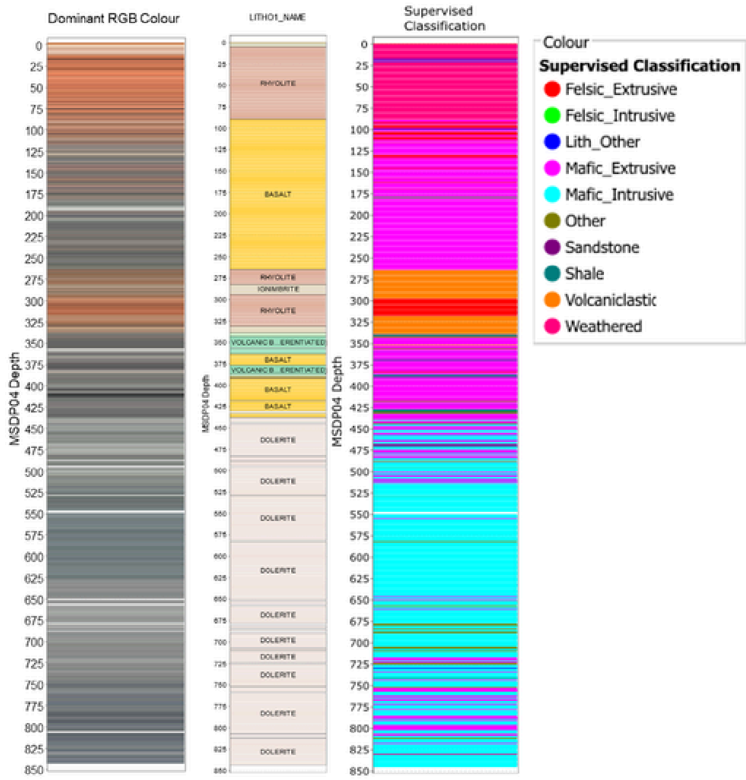

Figure 3. Downhole plots from MSDP04 showing (left) dominant RGB colour, (centre) Lithology logs from GSSA and (right) Supervised image classification from the Datarock Platform.

Analysing geochemistry data in ioGAS

Geochemistry data was generated from cuttings collected through the use of one of IMDEX's Solids Removal Units.

The samples, collected approximately every 1m, were split, dried, crushed and pressed into pellets which were analysed by a portable XRF on-site for a 34 element suite.

24 elements were chosen for further interpretation based on the percentage of data above the detection limit (i.e. DL, > 50% above DL).

Figure 3. 1000SC Surface Solid's Removal Unit supplied by IMDEX.

Unsupervised analysis

Geochemistry data can be similarly processed, where unsupervised clustering highlights the underlying groupings in the assay data which are related to differences in rock types.

Uniform Manifold Approximation and Projection (UMAP) was used on the 24 selected elements, which were transformed to Log10 and scaled from 0 to 1.0 prior to analysis.

The resulting 2 UMAP dimensions were clustered using the Density-Based Spatial Clustering of Applications with Noise (DBSCAN) technique, which identified 11 clusters (Figure 6).

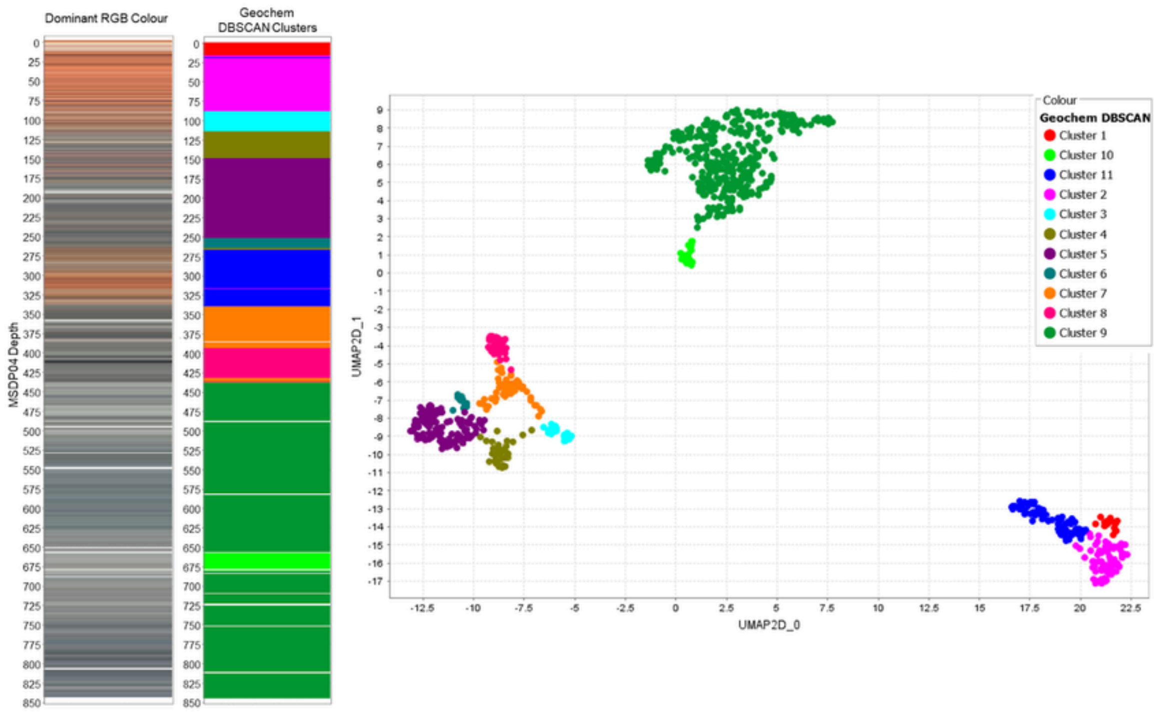

Figure 4. MSDP04 downhole plots with (left) Dominant RGB colour (right) DBScan cluster colours. 2D UMAP of LAR geochemistry features coloured by DBScan clusters.

Comparing geochemistry and imagery in UMAP space

By visualising the data in similarity space we can see how discrete and well separated the data is. Data points that plot close together should be similar in terms of either their multivariate geochemical signature or visual appearance.

The geochemistry and imagery UMAPs (right) both show clear structure with obvious groups of data but with some interesting differences.

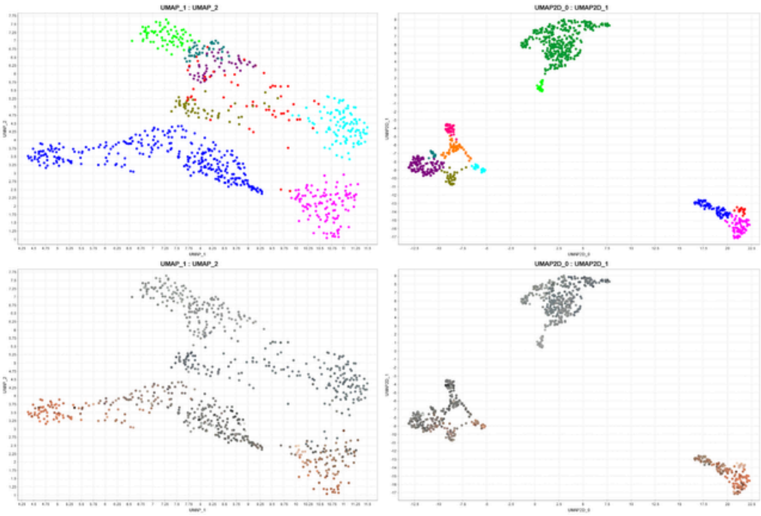

Figure 5. UMAP of imagery vectors (left 2 plots) and UMAP of geochemistry variables (right 2 plots). The colours on the top 2 represent unsupervised DBScan clusters, and the colours on the bottom 2 plots are dominant RGB colours per interval.

Comparing domains using wavelet tessellation

Comparison of domains created using unsupervised techniques on both imagery and geochemistry data highlighted similarities in major boundaries but also some differences. This image illustrates the use of the Wavelet Tessellation tool in ioGAS to compare geochemical to core imagery domains.

We compare regions where the rocks were identified as geochemically homogeneous but visually and texturally distinct (A, E), but also regions where we see strong overlapping geochemical and visual boundaries (B, C, D).

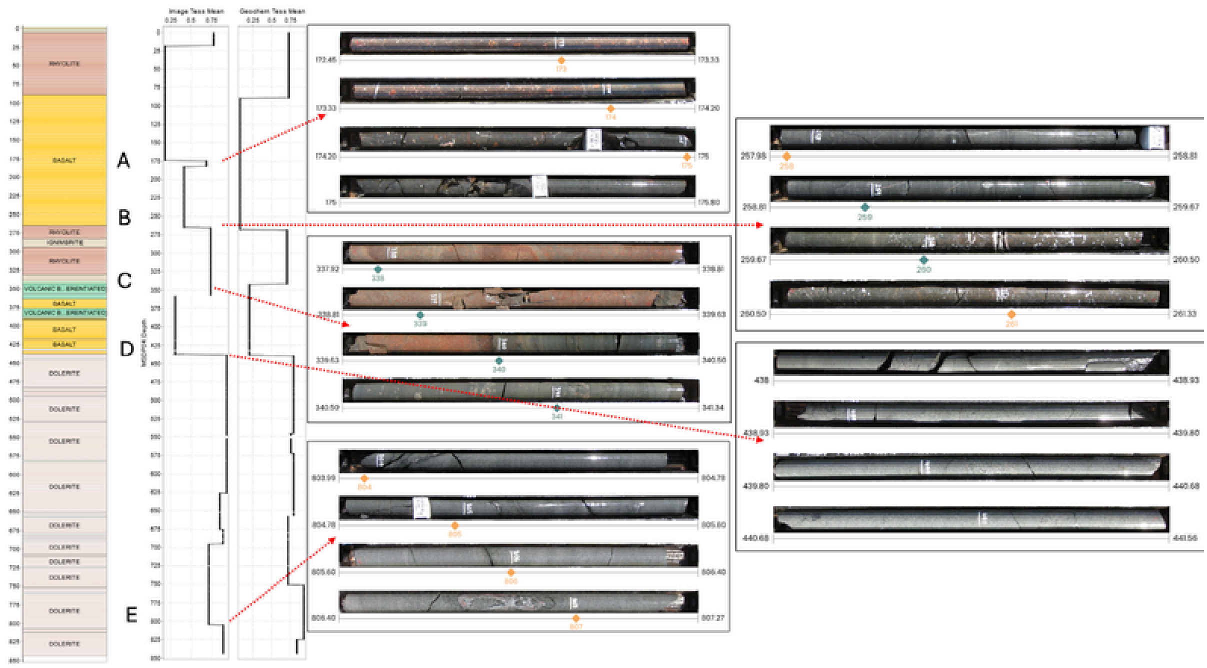

Figure 6. Average UMAP value per tessellation showing the comparison of boundaries in each dataset (left). Core photos with several key boundary locations showing the change in the visual appearance of the geology (right).

Value to customer

The Datarock Platform provides structured datasets that can be easily combined with geochemistry data in the ioGAS software to provide a better understanding of the geology.

Core imagery provides visual and textural context to the geology, and the geochemistry data provides a spatial and geological process-driven insight into the formation of the rock. Both datasets are complimentary and can highlight subtle boundaries that either dataset would not be able to show in isolation.

Processed core imagery data in analytics-ready format allows geoscientists to treat image data as additional numeric input alongside geochemistry data for machine learning and automation in the ioGAS software.

Read the full case study:

Combining Imagery and Geochemistry with ioGAS and Datarock – Photogeochemistry

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Learn more about:

ioGAS™

ioGAS is a leading exploratory data analysis software application developed specifically for the resources industry.

Effortlessly detect patterns, anomalies and relationships in your geoscience data in a fraction of the time.

imdex.com/software/iogas

Learn more about:

Datarock

The Datarock cloud hosted platform uses AI to extract geological and geotechnical data from core imagery.

Increasing Ore Body Knowledge to enhance net present value of your deposit and optimise mineral extraction.

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