IMDEX ioGAS™

IMDEX ioGAS™

Quick Start Tutorial

VERSION 7.1

IMDEXHUB-IQ ENABLED

© Imdex Limited 2019

Table of Contents

© Imdex Limited 2019

© Imdex Limited 2019

1. Open Data into ioGAS™

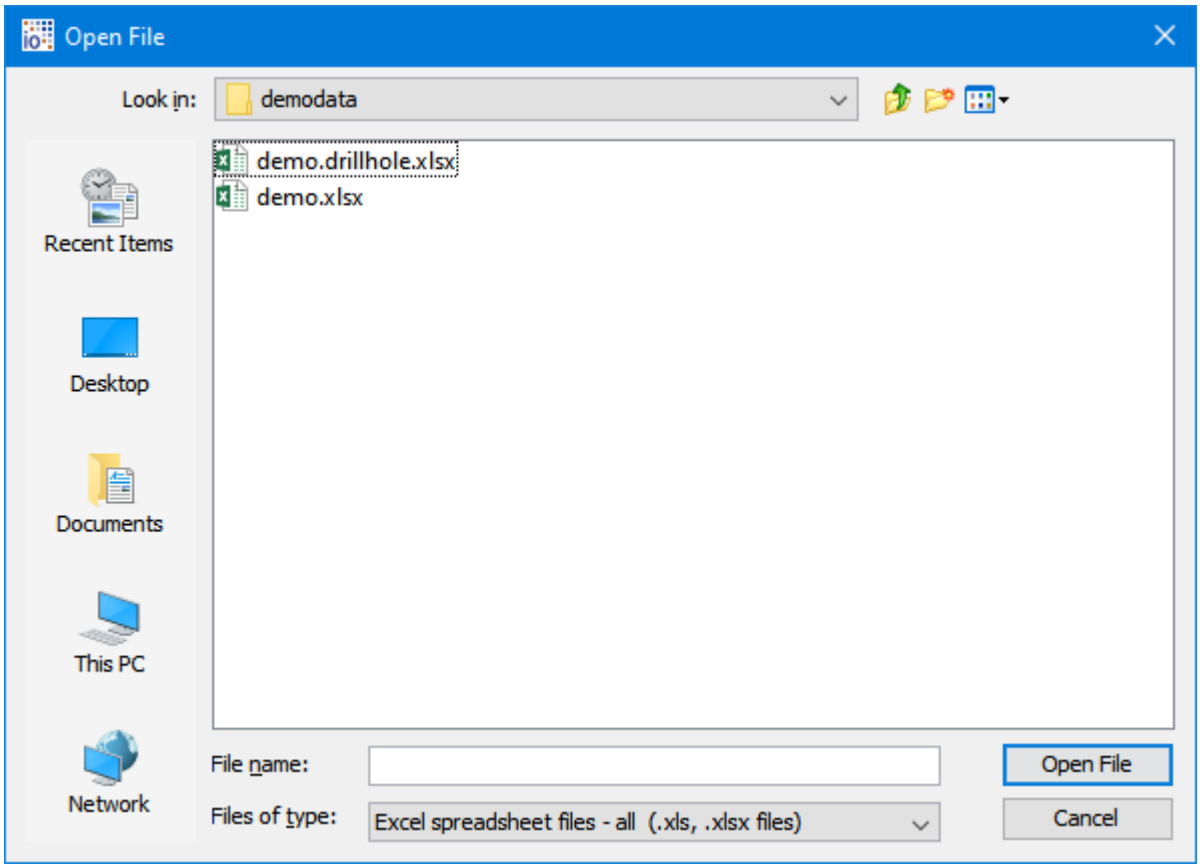
ioGAS™ supports the following file types:

- ioGAS™ (.gas files)
- Tab-delimited text (.txt files)
- Comma-delimited text (.csv files)
- Excel (.xls, .xlsx files)
- XRF (REFLEX & Olympus .csv & Niton .ntg files)
- MapInfo GIS (.tab files)
- External databases:
  - IMDEXHUB-IQ
  - acQuire GIM Suite
  - MS Access
  - SQL Server
  - ALS Webtrieve
- Live links: (purchased separately)
  - Leapfrog Geo
  - GOCAD Mining Suite
  - Geoscience ANALYST

Open Excel File

1. Click the  **Open** button on the **File** ribbon, or any other functional ribbon (other than Help).
2. Browse to one of the following locations depending on the installed operating system:
   - Windows (64-bit): **C:\Program Files\ioAnalytics\ioGAS™-64.Version\demodata** folder
   - Mac installation: ioGAS™ **Application\Contents\Resources\app\demodata** folder
3. Use the drop-down arrow next to **Files of type:** and select **Excel Spreadsheet files - all (.xls, .xlsx files)**.
4. Highlight the **demo.xlsx** file and click on the **Open File** button.

© Imdex Limited 2019

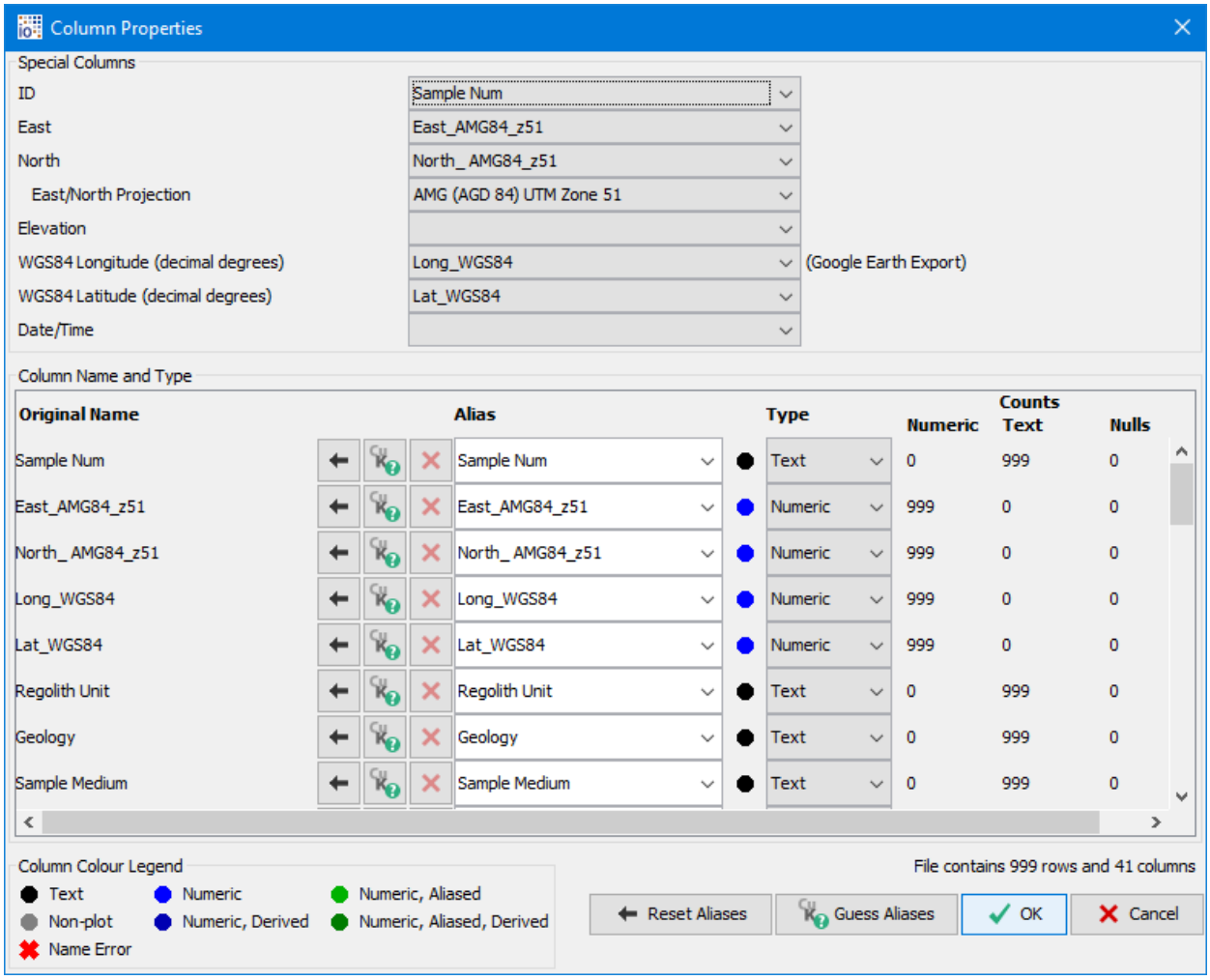


Alternatively drag and drop the file from Windows Explorer directly into ioGAS™, or copy data open in Excel into the system clipboard and use the **File> Open from Clipboard** ribbon option.

© Imdex Limited 2019

2. Define Column Types

Generally when a dataset is first imported into ioGAS™ the **Column Properties** dialog is displayed. This is where columns in the dataset are matched to columns required by ioGAS™ in order for data to be plotted successfully.



Special Columns

This section is where the sample number and coordinate columns in the dataset are selected so they can used to display data in the plot windows. ioGAS™ will use the column names in the dataset to automatically assign the special columns. The columns can be manually changed to the correct ones or left blank if the dataset does not contain any matching columns.

- **ID** - Unique sample identifier.
- **East/North** - X and Y coordinate columns. Used to display data in all spatial map views. Generally these will be in a projected coordinate system such as UTM coordinates.

© Imdex Limited 2019

- **East/North Projection** - Coordinate system used for East/North columns above. This is the projection that is used in the geographical file exports, e.g. gridded images as GeoTiff Images or ER Mapper grids, ArcGIS and MapInfo exports
- **Elevation** - Z value column. Required to display data in 3D Attribute Maps.
- **WGS84 Longitude/Latitude (decimal degrees)** - Separate X and Y lat/long coordinate columns in WGS84 decimal degrees required in order to export data to Google Earth.
- **Date/Time** - ioGAS™ recognises time/date data in Excel or ISO8601 format. Assign a date/time column here to ensure data is displayed correctly in the **Data View** window, the **Line Plot** tool and tooltip labels. Note that ioGAS™ does not support timezones.

1. Match the columns in the demo dataset to the following **Special Columns** in ioGAS™:
    - **ID** = Sample Num
    - **East** = East_AMG84_z51
    - **North** = North_AMG84_z51
    - **East/North projection** = AMG (AGD84) Zone 51
    - **WGS84 Longitude (decimal degrees)** = Long_WGS84
    - **WGS84 latitude (decimal degrees)** = Lat_WGS84

Column Name and Type

In the **Column Name and Type** area ioGAS™ automatically assigns each column in the dataset as **Numeric** or **Text**. Analysis data to be used in plots is generally numeric whereas text data is used to 'group' data, for example Regolith Unit, Geology, Sample Medium, etc. If a column is imported as a text field yet contains numeric data then the column can be re-assigned as a numeric column and vice versa.

In some cases it may be useful to assign columns as **Non-plot**. Examples of non-plot columns may include Sample ID or coordinate columns that will not be used in plot generation or data analysis.

2. Scroll down and have a look at the different column types assigned to this data-set.

    Text columns are denoted by a black circle and non-plot columns with a grey circle. **Numeric** columns can have either a blue circle or a green circle next to them

© Imdex Limited 2019

depending on whether they are "aliased" or not. See Step 4 for more information on aliasing variables. Red circles denote that there is a problem such as duplicate column names and will need to be fixed before exiting this dialog.

ioGAS™ lists the number of samples in each column that are numeric, text or null (blank) on the right-hand side of the dialog. At the bottom of the dialog is the number of rows (999) and columns (41).

3. Place the cursor over the original column name (without mouse clicking) to view tooltip information about the data in the selected column. Text columns display the individual categories and numeric columns display min, median and max values. If the tooltips do not appear, click within the Column Properties dialog to make it active and try again.

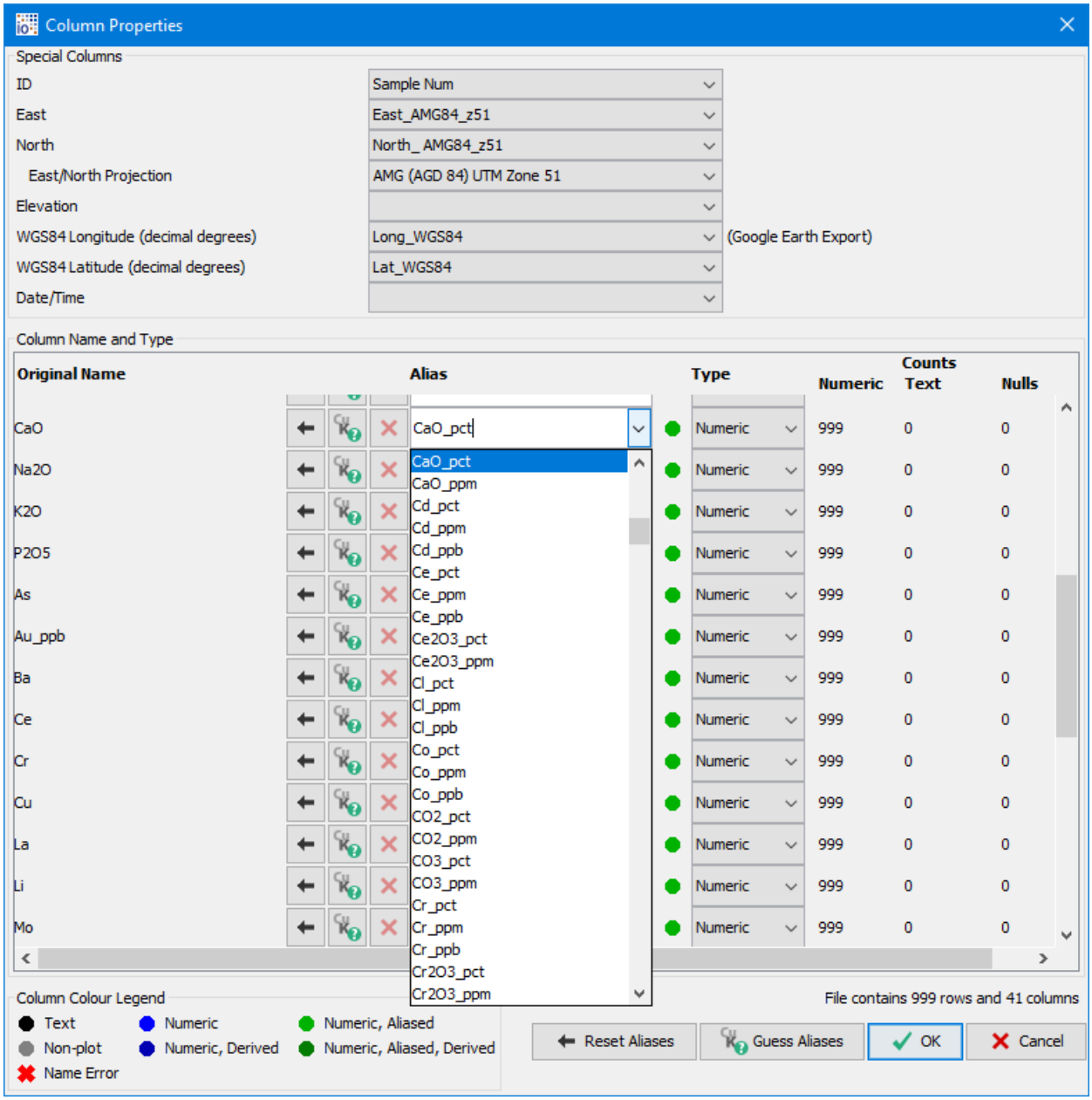
It is possible to plot data and use many of the functions within ioGAS™ without having an ID column or coordinate columns selected.

It is also possible to remove any columns before import by clicking on the cross next to the column to delete. These columns will be permanently removed from the imported dataset when the **OK** button is selected.

© Imdex Limited 2019

3. Set Column Alias Names

One very important feature of ioGAS™ is that if the element and the units that the values are captured in is known for each column, ioGAS™ can perform unit or element/oxide conversions on-the-fly in order to use the data with the classification diagrams, calculations and spider plot normalisations shipped with the program if the data is not already in the required format.



If ioGAS™ can already guess the "aliased" name from the original column name it will attempt to automatically assign an "aliased" name when the file is imported. E.g. Au_ppb

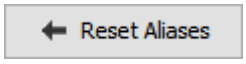
© Imdex Limited 2019

Alias Columns

Use the following steps to "alias" the columns in the demonstration dataset to standard element/unit names:

1. Click on the **Guess Aliases** 

button. ioGAS™ automatically guesses the element and unit from the original column name for all columns. To alias a single column at a time use the **Guess Alias**  button next to each variable.
2. It is important to check to make sure that the correct element/oxide/unit combination name is applied.

   To manually assign an alias name to a column select the appropriate element/oxide/unit combination from the **Alias** pull-down list. To reset a single column back to the original name click on the **Reset Alias**  button next to each column or reset them all using the **Reset Aliases** 

button.

3. Observe the original names in the demonstration dataset compared with their "aliased" names. The blue circles next to each variable are now coloured green to indicate the variables are "aliased".

In ioGAS™ all variables can be renamed as desired with the new name used everywhere in the program. To enter a new name for a column simply overwrite the one displayed in the **Alias** column for that variable.

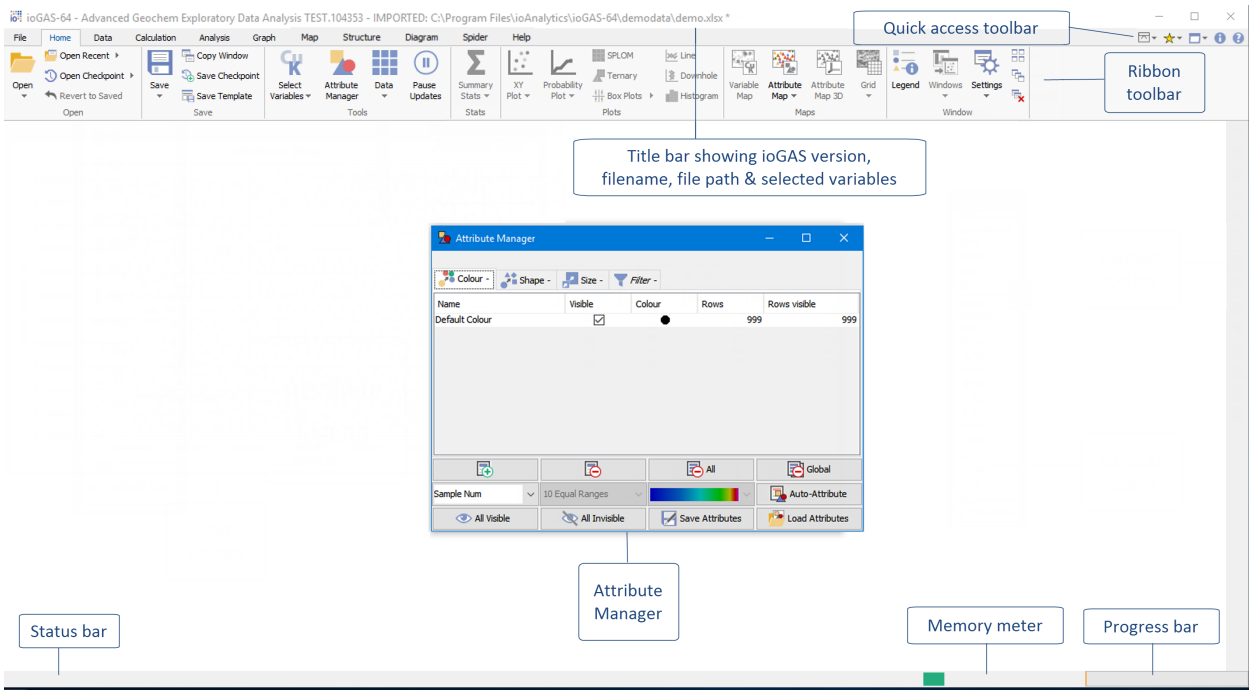
4. When you are satisfied that the columns are "aliased" correctly click **OK** to proceed.

The **Column Properties** settings are retained when the file is saved in ioGAS™ format and can be modified at any time by clicking on  **Column Properties** in the **Data** ribbon or from the  **Data** drop-down menu on all ribbons (except File & Help).

© Imdex Limited 2019

4. User Interface & Attribute Map

The demo dataset is now loaded into ioGAS™ with the file name and path displayed in the title bar of the program.



The ioGAS™ user interface is comprised of a number of components:

Title bar

The **Title Bar** displays the ioGAS™ version, build and the file name and file path of the currently open dataset.

Ribbon Toolbar

The tabs along the menu bar at the top of the screen open a corresponding ribbon toolbar where features are grouped into bands of related functionality. Frequently used functions are laid out as large icons, many with related functions in drop-down menus. Less frequently used functions are laid out as small icons.

If this is the first dataset loaded into ioGAS™ for this work session then the **Home** ribbon toolbar should be currently displayed. If not, click on the **Home** tab to display this ribbon.

© Imdex Limited 2019

Quick Access Toolbar

On the right side of the menu bar is the **Quick Access Toolbar** containing tools that are relevant in any context: show/hide ribbon, favourite tools list, open windows list, display attribute legend and help.

Attribute Manager

The **Attribute Manager** controls the way each data point is "attributed" when it is displayed in a plot window with respect to colour, shape, size and visibility. The Attribute Manager can also be used to set a filter on the dataset in order to create a subset of data.

Status Bar

Displays information about toolbar icons along with other important warning and error messages when processes are run to let users know if there are any problems, e.g. when data cannot be logged due to 0's or negative values, missing variable data when displaying mineral nodes, etc. Warning messages are displayed in red.

Progress Bar

Some processes can take a while to complete. This orange bar can be used as a visual aid to view progress.

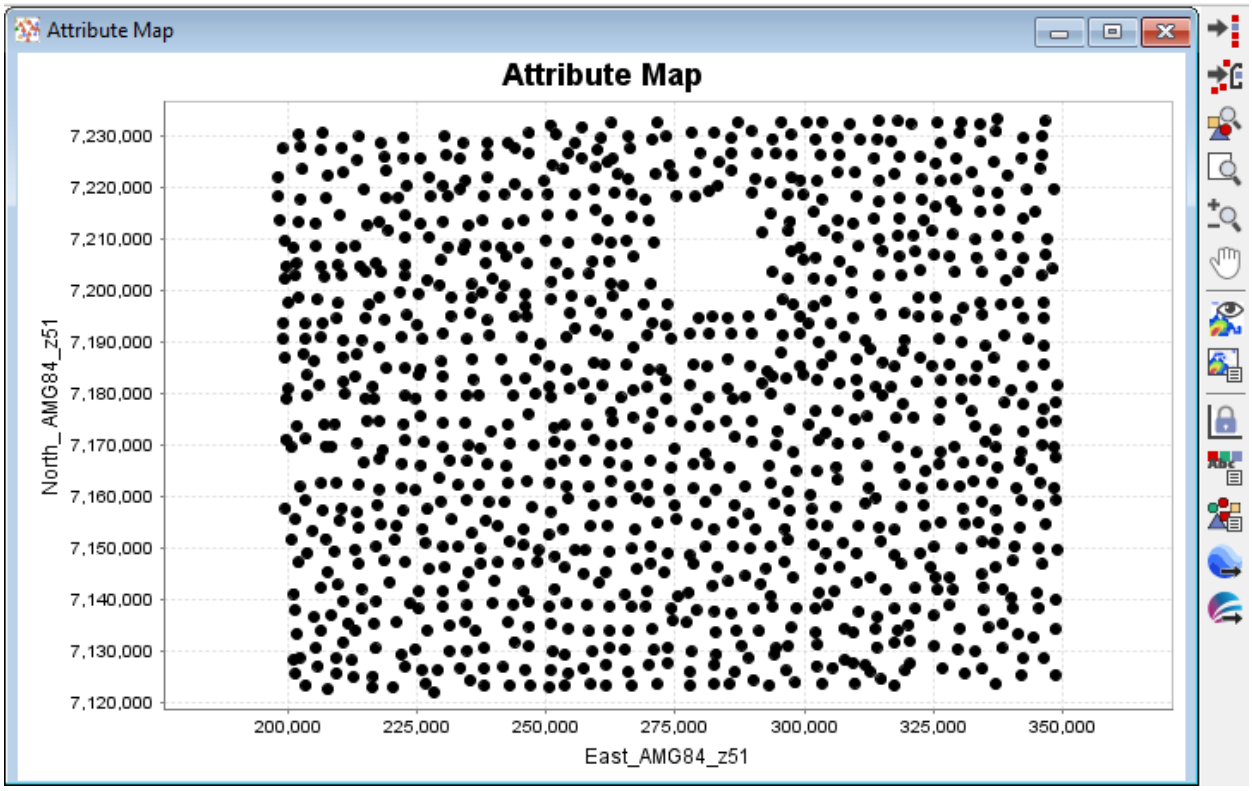
Memory Meter

The Memory Meter shows the actual memory being used by ioGAS™, as a fraction of available memory. The meter is intended as a guide to help the user decide when to close windows as the memory gets close to its limits.

Attribute Map

An **Attribute Map** is a pseudo-map or geographical view of a dataset that plots the X coordinates against the Y coordinates. It is used to view a dataset in a spatial context and is one of the main plot types used with Google Earth and GIS programs such as ArcGIS or MapInfo.

1. Click on  **Attribute Map** on the **Home** ribbon.



Context Toolbar

When the Attribute Map is open, a number of buttons are displayed vertically on the right-hand side of the screen. This is the Attribute Map context toolbar and contains tools relating to this plot window. To make the context toolbar active click in the plot window or on the window title bar. Place the cursor over each toolbar button to view information about each tool in a tooltip.

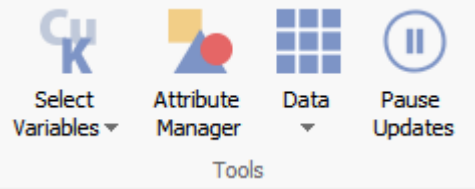
To move the **Attribute Map** window click on the window title bar and drag to a new location while holding down the left-mouse button. Plots and other windows open in ioGAS™ can be re-sized by placing the cursor over one of the edges of the window and then dragging it in or out. Minimise, Restore and Close buttons  are also available in the top right hand corner of each open window.

5. Select Variables

Before any data can be displayed in a plot window (aside from an Attribute Map if coordinates are present) the variable columns must be selected for use. The current variable selection is generally shown in the main window title after the file name, which in this case is empty as there are no variables selected yet.

Notice that a number of icons are greyed out on the ribbon. This also indicates that either no variables are selected for use or that not enough variables are selected to display that particular plot, e.g. a ternary plot requires three variables to be selected before the icon is active.

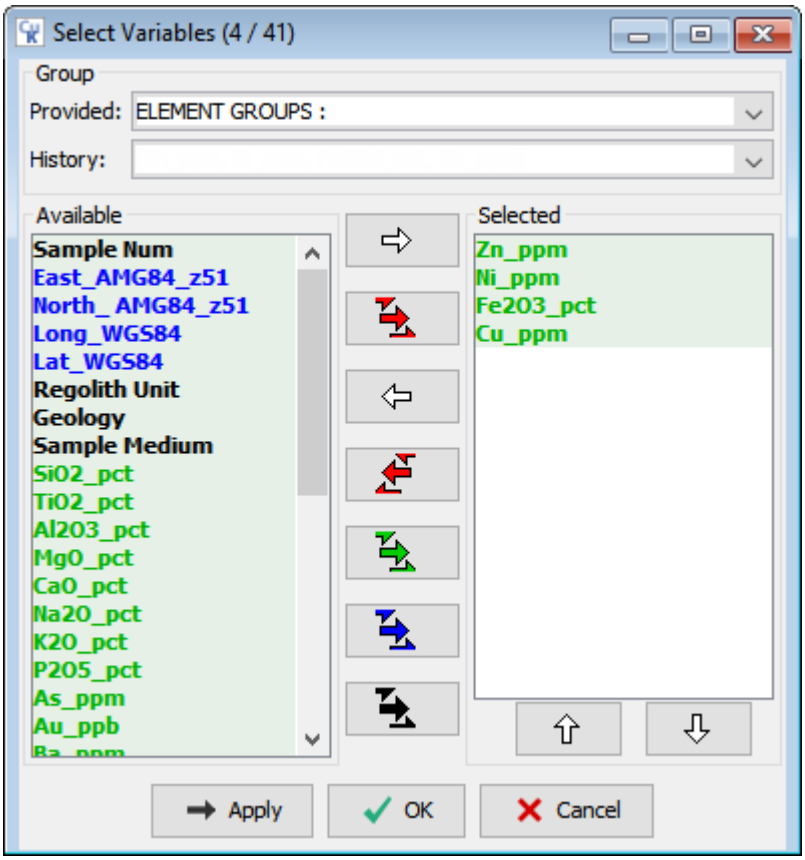
The **Select Variables** tool is located on the **Tools** band of the **Home** ribbon along with other commonly used tools such as the Attribute Manager, Data and Pause Updates which will be discussed later in this tutorial. This suite of tools is also available on the **Common Band** on most of the other ribbon toolbars.



1. Click on **Select Variables** on the **Home** ribbon to display the Select Variables dialog.
2. Add the following variables to the **Selected** window: **Zn_ppm**, **Ni_ppm**, **Fe2O3_pct** and **Cu_ppm**.

   To select an individual variable double-click on the entry in the **Available** window to move it across to the **Selected** window or use the arrows in the middle of the dialog. Multiple selections can be made using the Ctrl/Shift keys.

© Imdex Limited 2019



Observe that the colour of the variable columns match the colours used in the **Column Properties** dialog. All of the selected variables are green as they are numeric columns that have been "aliased" to the standard ioGAS™ element/unit names. The black variables are text fields and can be selected for use with plots if they will produce meaningful results. Numeric variables which have not been aliased will appear in blue.

To sort the order of the variables alphabetically in the **Available** window use the right-mouse button. The variables are sorted within each "type", e.g. text, numeric, aliased, etc. Click again to return to file order.

The order of the variables in the **Selected** window can be modified using the **Up** and **Down** arrows or by dragging to a new location with the mouse cursor. For some plots such as XY Scatterplots the first variable is used as the X axis when there are multiple variables to be plotted. Ternary plots use only the first three variables in the **Selected** window so re-ordering is often required to ensure the correct variables are displayed.

Once you are more familiar with the software there are a couple of ways to select multiple variables at a time rather than having to select them each time:

© Imdex Limited 2019

Provided

Drop-down list containing groups of commonly used elements provided by ioGAS™. Individual variables can be added or removed from these selections. Provided groups include:

- Element Groups - Majors , Immobile, REE, PGM
- Deposit Style - Porphyry Cu-Au, Epithermal/Meso-thermal/Orogenic/Laterite Au, IOCG, MVT, VHMS, plus many more.
- Secondary Scavenging - Fe and Mn Oxides
- Goldschmidt - Chalcophile, Lithophile, Siderophile

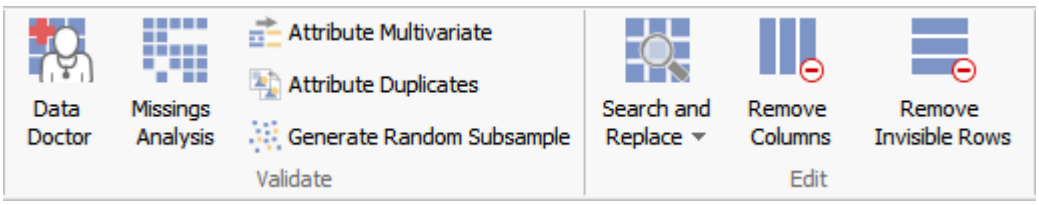
History

Each variable selection is saved and is available to be selected for use again within the current dataset from the History pull-down list.

3. Click **OK** to exit the dialog.

Now that a number of variables are selected for use all of the tools on the Home ribbon are now active. The current variable selection is also displayed in the ioGAS™ title bar after the open file name.

6. Validate Data



1. Click on the Data tab to open the **Data** ribbon and have a look at the options in the **Validate** and **Edit** bands. These include:

    **Data Doctor**

   The Data Doctor tool displays the number of null, 0, -, > and < records for each of the selected variables. Using this tool It is possible to replace below detection limit values with a ½ positive value or custom value and above detection values with a custom value. Colour attribute any of these samples in open plot windows to see where they are located. Any changes made to the data are recorded in a log file for future reference.

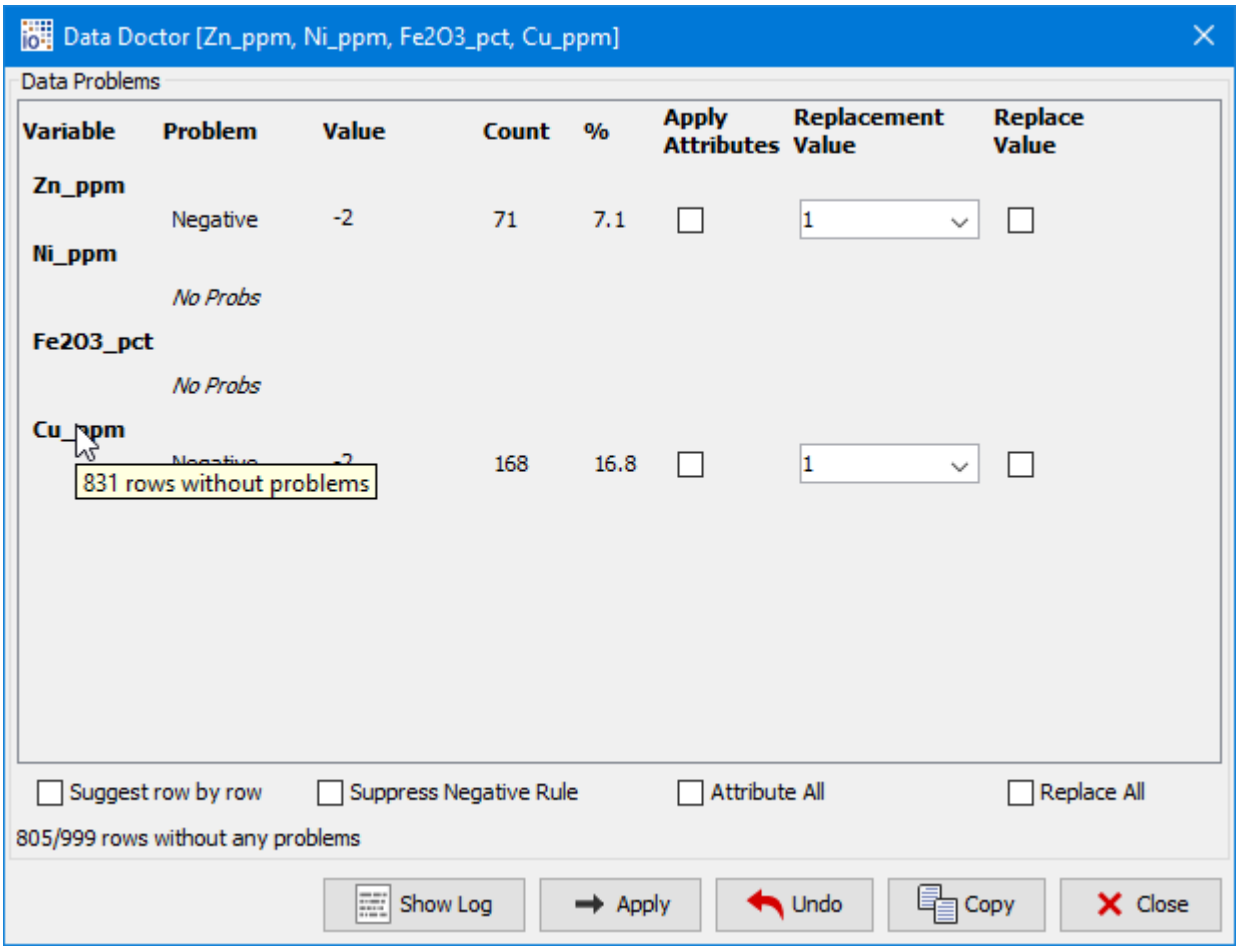
    **Search and Replace**

   Replace text or numeric entries in selected columns or the entire dataset. All modifications are reported in the change log file.

   - **Convert Zeros to Nulls (Coordinate Columns)** (under Search and Replace drop-down menu) - Replace zero entries in coordinate columns with null values to prevent them from plotting at 0,0 in map views.

2. Click on  **Data Doctor**.

© Imdex Limited 2019



The Zn_ppm and Cu_ppm columns contain some below detection limit data. The validation type, the value, the number of samples with this value and the % of affected valid data is displayed along with a recommended replacement value which in this case is 1 (the half positive value of the below detection limit, i.e. -2).

3. Check the **Replace Value** box next to each entry and then click **Apply**.

   As the replacements are made the updated Data Doctor reports that there are now no data validation problems with the dataset.

4. Click on the **Show Log** button at the bottom. In the **Change Log** window scroll to the right to view the number of Zn_ppm and Cu_ppm occurrences that have been updated with the new replacement value.

   The **Change Log** file lists all changes to a dataset from when it is first imported into ioGAS™ and records all data validation replacements, columns removed and rows deleted. The Change Log can be accessed at any time using the **Data>Show Change Log** ribbon option.

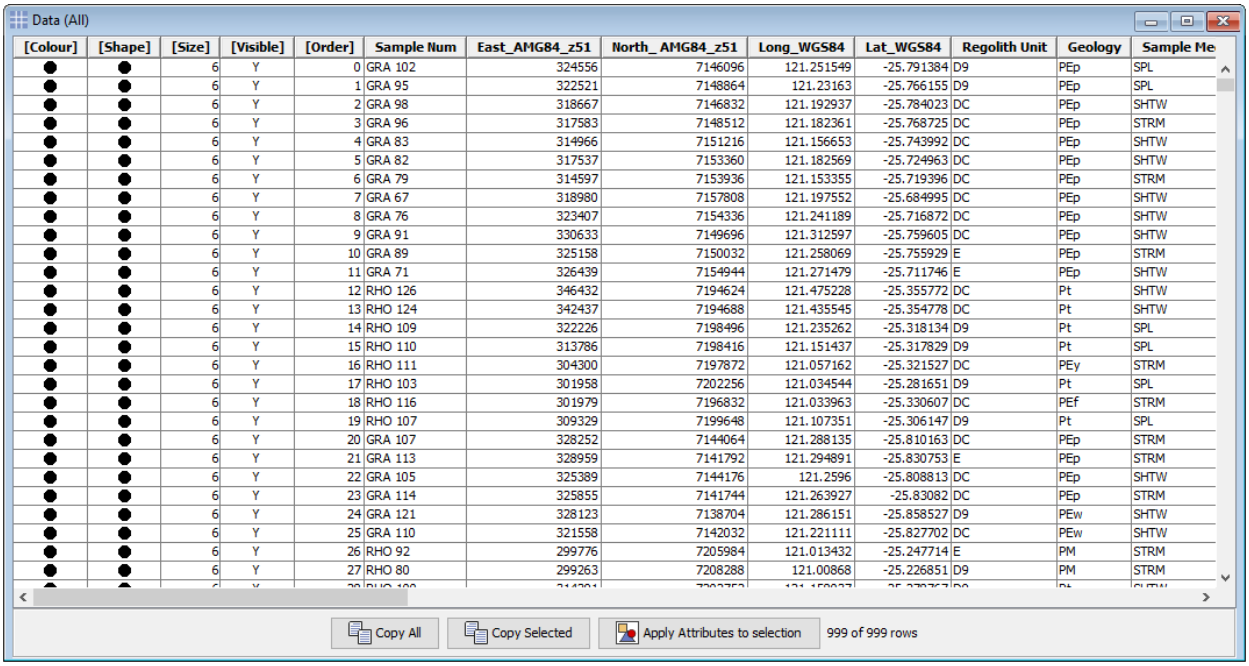
5. Select **Close** to exit this window and then **Close** to exit the Data Doctor window.

© Imdex Limited 2019

7. Display Data in Tabular View

The **View Data** tool displays the dataset in a spreadsheet or tabular view as rows/columns.

1. Select **Data** from the Tools band of the **Home** ribbon. This will display all the columns in the dataset regardless of what variables are selected.
2. Use the scroll-bars to scroll up and down and left and right to get a feel for the columns in the dataset. Observe the colour, shape, size and visible columns on the left-hand side. These columns show the current attributes that are applied to each data row. These are currently set to the default attributes which are a black circle, 6 pt in size.
3. Sort a variable column in ascending order by left-mouse clicking once in the column header. Click again in the header to reverse the sort. The **[Order]** column is automatically generated when the data is imported and can be used to sort the data back to its original import order at any time.
4. It is possible to click on rows in this view and apply colour/shape/size attributes to the selection using the **Apply Attributes to Selection** button. This will be covered later in this tutorial. Data can also be copied into other programs using the two **Copy** buttons at the bottom of the dialog.
5. Close the **Data** window using the **X** in the top right hand corner.



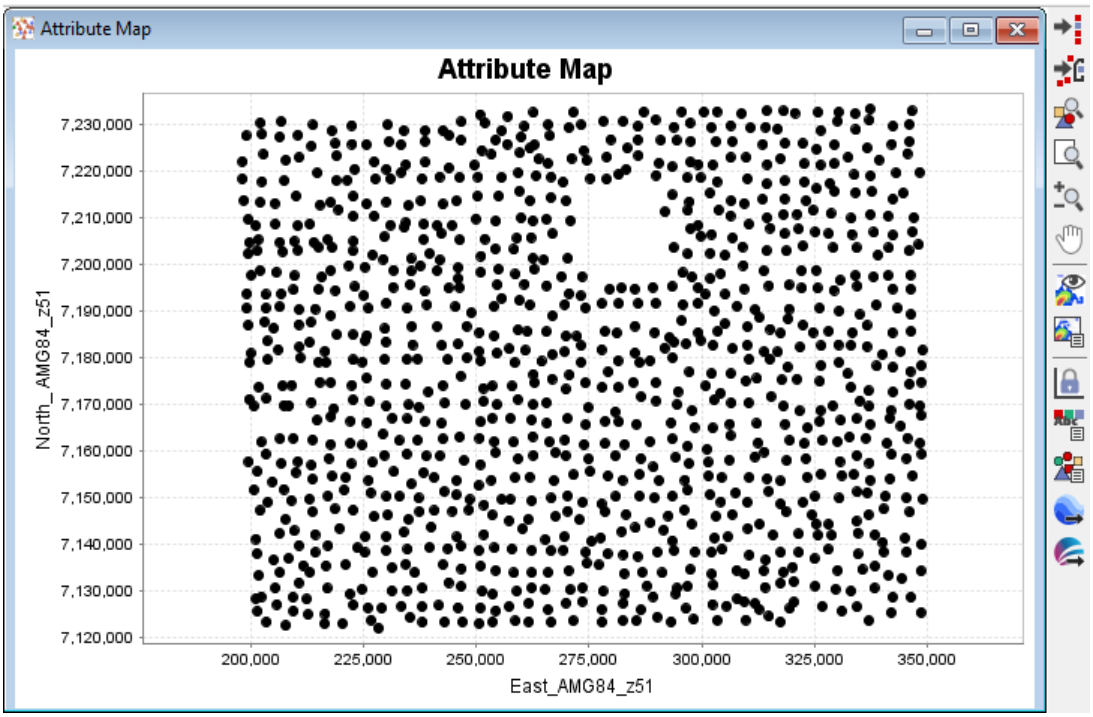
[Colour]	[Shape]	[Size]	[Visible]	[Order]	Sample Num	East_AMG84_z51	North_ AMG84_z51	Long_WGS84	Lat_WGS84	Regolith Unit	Geology	Sample Me
●	●	6	Y	0	GRA 102	324556	7146096	121.251549	-25.791384	D9	PEp	SPL
●	●	6	Y	1	GRA 95	322521	7148864	121.23163	-25.766155	D9	PEp	SPL
●	●	6	Y	2	GRA 98	318667	7146832	121.192937	-25.784023	DC	PEp	SHTW
●	●	6	Y	3	GRA 96	317583	7148512	121.182361	-25.768725	DC	PEp	STRM
●	●	6	Y	4	GRA 83	314966	7151216	121.156653	-25.743992	DC	PEp	SHTW
●	●	6	Y	5	GRA 82	317537	7153360	121.182569	-25.724963	DC	PEp	SHTW
●	●	6	Y	6	GRA 79	314597	7153936	121.153355	-25.719396	DC	PEp	STRM
●	●	6	Y	7	GRA 67	318980	7157808	121.197552	-25.684995	DC	PEp	SHTW
●	●	6	Y	8	GRA 76	323407	7154336	121.241189	-25.716872	DC	PEp	SHTW
●	●	6	Y	9	GRA 91	330633	7149696	121.312597	-25.759605	DC	PEp	SHTW
●	●	6	Y	10	GRA 89	325158	7150032	121.258069	-25.755929	E	PEp	STRM
●	●	6	Y	11	GRA 71	326439	7154944	121.271479	-25.711746	E	PEp	SHTW
●	●	6	Y	12	RHO 126	346432	7194624	121.475228	-25.355772	DC	Pt	SHTW
●	●	6	Y	13	RHO 124	342437	7194688	121.435545	-25.354778	DC	Pt	SHTW
●	●	6	Y	14	RHO 109	322226	7198496	121.235262	-25.318134	D9	Pt	SPL
●	●	6	Y	15	RHO 110	313786	7198416	121.151437	-25.317829	D9	Pt	SPL
●	●	6	Y	16	RHO 111	304300	7197872	121.057162	-25.321527	DC	PEy	STRM
●	●	6	Y	17	RHO 103	301958	7202256	121.034544	-25.281651	D9	Pt	SPL
●	●	6	Y	18	RHO 116	301979	7196832	121.033963	-25.330607	DC	PEf	STRM
●	●	6	Y	19	RHO 107	309329	7199648	121.107351	-25.306147	D9	Pt	SPL
●	●	6	Y	20	GRA 107	328252	7144064	121.288135	-25.810163	DC	PEp	STRM
●	●	6	Y	21	GRA 113	328959	7141792	121.294891	-25.830753	E	PEp	STRM
●	●	6	Y	22	GRA 105	325389	7144176	121.2596	-25.808813	DC	PEp	SHTW
●	●	6	Y	23	GRA 114	325855	7141744	121.263927	-25.83082	DC	PEp	STRM
●	●	6	Y	24	GRA 121	328123	7138704	121.286151	-25.858527	D9	PEw	SHTW
●	●	6	Y	25	GRA 110	321558	7142032	121.221111	-25.827702	DC	PEw	SHTW
●	●	6	Y	26	RHO 92	299776	7205984	121.013432	-25.247714	E	PM	STRM
●	●	6	Y	27	RHO 80	299263	7208288	121.00868	-25.226851	D9	PM	STRM

© Imdex Limited 2019

8. Navigation Tools and Labels

1. Go back to the Attribute Map window that was opened earlier.

   To re-open this plot select  **Attribute Map** from the **Home** ribbon. The context toolbar is displayed on the right-hand side of the screen. Maximise the window to make it easier to see.



On the Attribute Map toolbar are a number of standard tools available to navigate within a plot window.

Zooming and Panning

2. To zoom in on an area click on  **Zoom to Box** and drag a box in the window over some data points using the left mouse button. The window contents are zoomed to the extents of this box. Alternatively, place the cursor in the plot window and use the scroll bar on your mouse to zoom in and out at the cursor location.
3. Select  **Pan** and click and drag the left-mouse button in the plot window to pan the view.
4. Right-mouse click in the plot window and select **Zoom Previous** from the pop-up menu. To restore the data to the original extents right-mouse click again and select **Zoom to Data**.

© Imdex Limited 2019

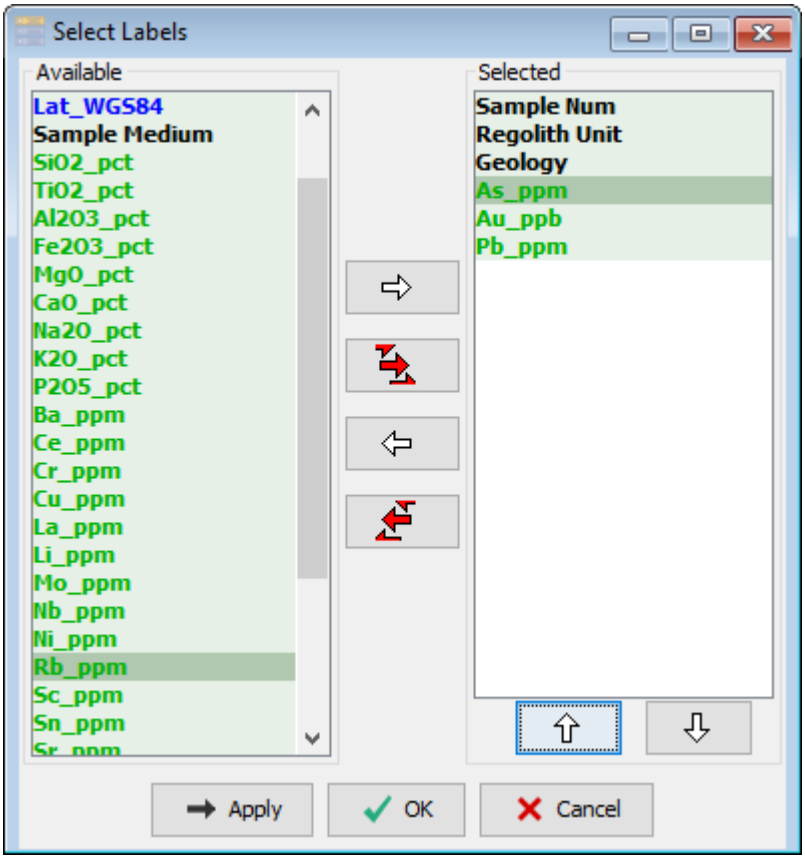
5. You can also use the **Dynamic Zoom** tool to zoom in and out by holding down the left-mouse button in the plot window and then dragging it up to zoom out or down to zoom in. The scroll bar on the mouse can also be used to zoom in and out if available. Restore the plot view when you are finished.

View Data Tooltips and Labels

Place the cursor over a data point in the plot window (without clicking) until a tooltip information box is displayed. The information displayed in this box includes the ID, East and North coordinates, any colour/shape/size attribute groups which are assigned and any data columns selected to be displayed as labels. e.g. Regolith and Geology units to which the sample belongs.

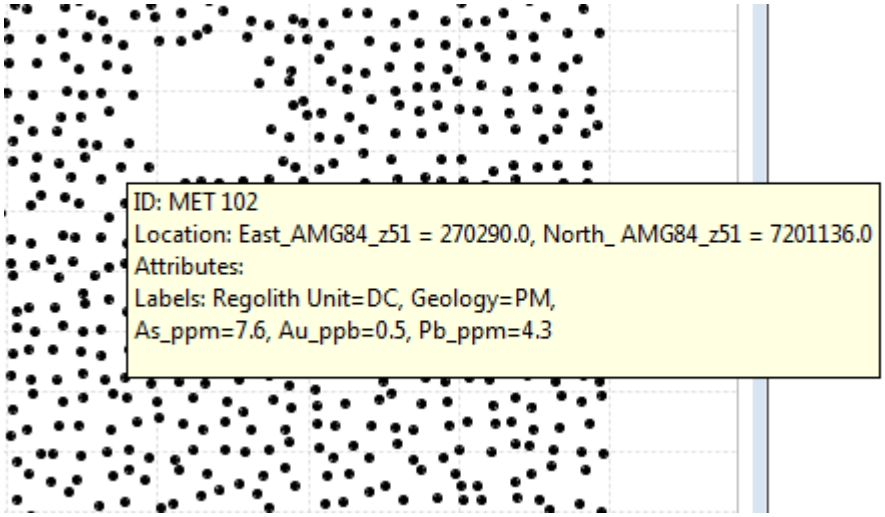
If the tooltip is not displaying, click in the title bar of the Attribute Map window to make it active and then try again.

6. Click on **Select Labels** on the Data ribbon. This is where it is possible to choose which other columns will display in the tooltip information box.



© Imdex Limited 2019

7. Select the Sample Num, Regolith and Geology columns and a couple of other variables and move them into the **Selected** window. Click **OK** to exit the dialog.
8. Click back in the **Attribute Map** window to make it active and place the cursor over a sample. The new label columns are now displayed.



9. To display the Sample Num as label in the attribute map window select **Rendering Settings** on the toolbar and check the **Show item labels** box. Click **Apply** to view the labels in the plot window. Zoom in to display more labels.

Attribute Maps can also be created from the Map ribbon.

© Imdex Limited 2019

9. Open Multiple Plot Windows

Now it is time to open some of the other plots available in ioGAS™ and look at the different ways that they can be displayed.

Scatterplots

1. Select  **XY Plot** from the Plots band of the **Home** ribbon.

   See that only three XY plots are created. This is because although four variables are selected: **Zn_ppm**, **Ni_ppm**, **Fe2O3_pct** and **Cu_ppm**, the first variable **Zn_ppm** is used as the X axis and the other variables as the Y axis.
2. With the XY Plot window as the active window, select  **Log X Axis** and  **Log Y Axis** from the XY toolbar to change the X and Y axes from raw data values to log scale.
3. Click on each of the  or  buttons to change each of the X and Y axes to a **Power Transformed** axis. ioGAS™ uses a Lambda power transformation method to de-skew data so it more closely approximates a normal distribution. Click on these buttons again to return to linear axes.

Probability Plots

4. Select  **Probability Plot** from the Plots band of the **Home** ribbon.

   Each variable is displayed as an individual probability plot in a single window. Observe that the Probability toolbar contains similar zoom, pan and log/power transform options as the XY toolbar.
5. Click on  to display probability values along the X axis instead of N-Score (std dev) values.
6. To change the view to a cumulative frequency plot distribution click on the  button. To return to normal probability right-mouse click on the button and select **Normal**.

Histograms

7. To display individual plots in a tabbed window go to the Window band, click on the arrow under  **Settings** and choose **Tabbed windows** from the drop-down

© Imdex Limited 2019

menu. A circle is placed next to this menu entry to show this window mode is selected.

8. Select **Histogram** from the Plots band.

   Observe that each of the variable histograms is displayed in a separate tab in the same plot window instead of all in the same plot window like the XY and probability plots. Click on the tabs to view each histogram.

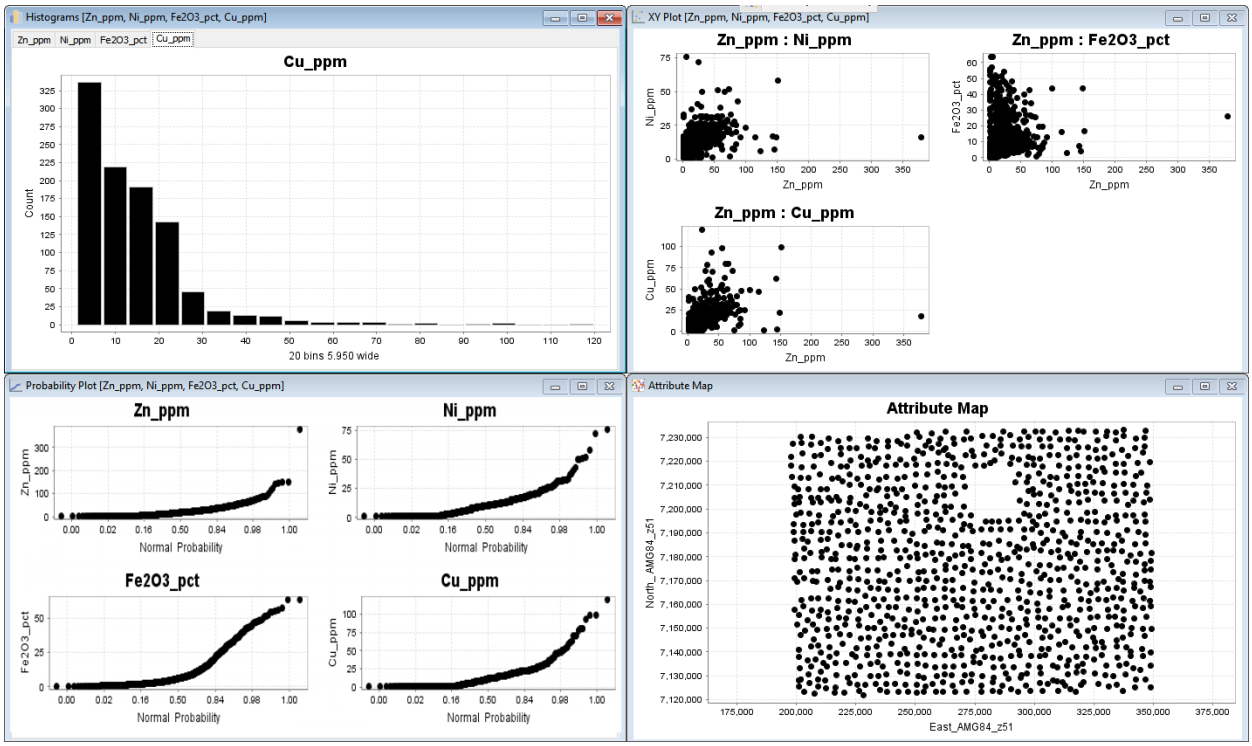
9. The histograms show the number of samples in each binning range. Use the and arrows on the Histogram toolbar to increase or decrease the number of bins.

Arrange Windows

There should now be four plot windows open in ioGAS™ but they are most likely all displaying on top of each other.

10. To arrange multiple windows click **Cascade** on the Window band to view all the windows with their title bars visible.

11. Now select **Tile** to view all the plot windows without overlapping.



12. Click on **Save Checkpoint** in the Save band on the **Home** ribbon. Enter a name for the checkpoint such as **Multiple Plot Windows** and click OK.

    A checkpoint saves the currently open plot windows and settings and can be restored at a later point in time.

13. Go back to **Settings** and choose **Normal windows** from the drop-down menu to return to the default window display. The selected window mode will apply to new windows only, not those already open.

XY, Probability Plots and Histograms can also be created from the Graph ribbon.

© Imdex Limited 2019

10. Apply Colour/Shape/Size Attributes

Now that there are some plot windows created, this next section looks at how to change the colour, shape and size attributes for individual data points, apply them to data selections and turn the visibility of data points on and off. This is all controlled by the **Attribute Manager.**

1. Select  **Attribute Manager** from the Tools band on the **Home** ribbon. The Ctrl-A keyboard shortcut can also be used to open the **Attribute Manager** window.

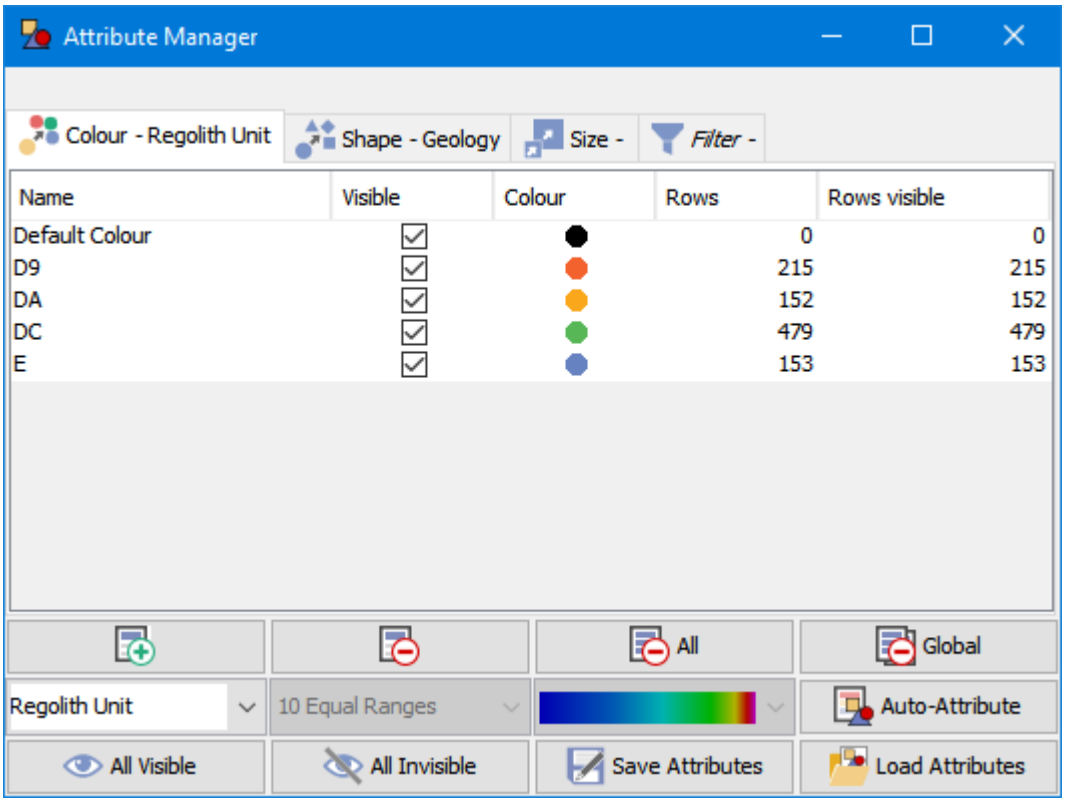
   The **Attribute Manager** contains three main tabs, one each for colour, shape and size. This means that for every data point the values for up to three variables can be displayed simultaneously, one for each attribute. By default, all of the samples in the dataset will be attributed unless a subset of data is selected for use in the **Filter** tab. When a Filter is set only the filtered data samples will be attributed.

Auto-Attribute Text Data

Auto-Attributing can be used to apply attributes to data based on unique values in a text column.

2. With the Colour tab active, select **Regolith Unit** from the drop-down list and click on the **Auto-Attribute** button.

© Imdex Limited 2019

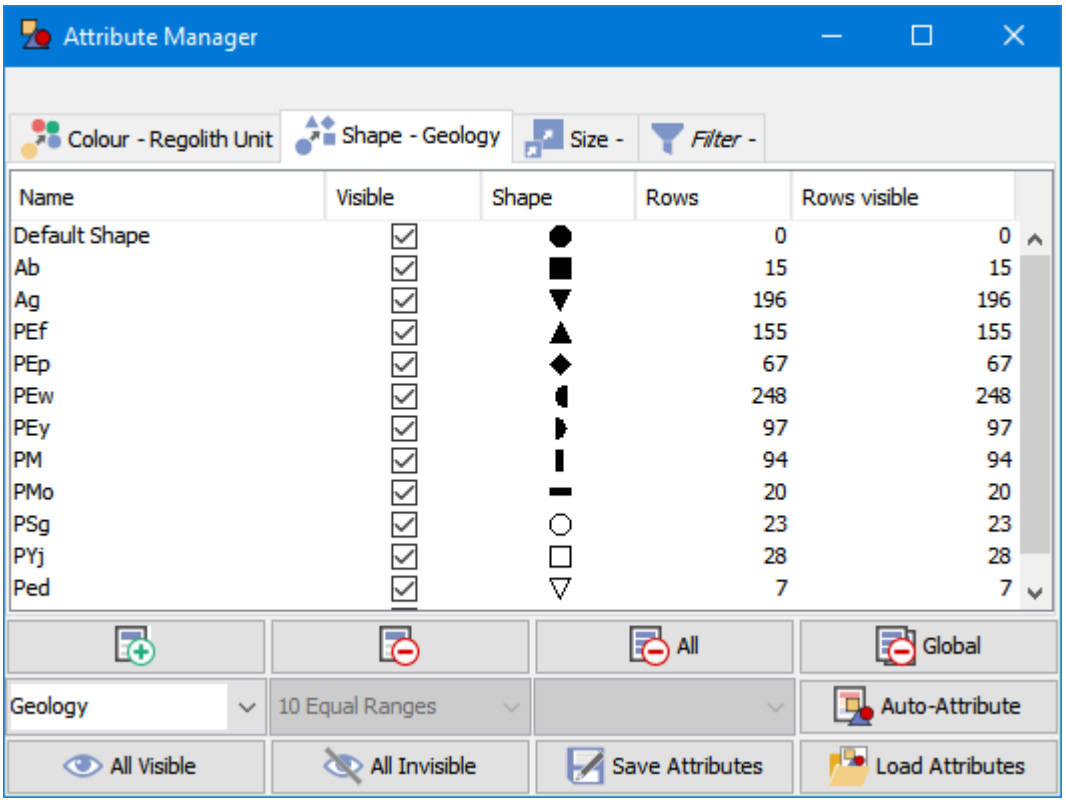


The data is now coloured by Regolith Unit in every plot window. The number of data points in each colour group is displayed along with how many of the points are currently visible.

3. Click on the **Shape** tab this time. Select **Geology** from the column pull-down list. Click on the **Auto-Attribute** button.

   The data points are now coloured by regolith unit with the shape representing the underlying geological unit.

© Imdex Limited 2019

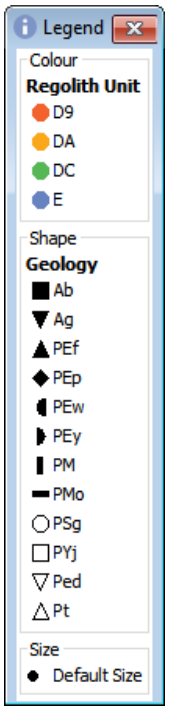


Show Legend

The legend window is another way of displaying the current Attribute Manager settings.

4. Click on **Legend** on the Window band of the **Home** ribbon to open up a separate **Legend** window. The legend window can also be opened up from the icon on the Quick Access toolbar or by the Ctrl-L keyboard shortcut.
5. To view the attributes in a combined legend, right-mouse click within the legend window and choose **Legend Mode - Combined/Separate**. Click this option again to return the default legend view.

© Imdex Limited 2019

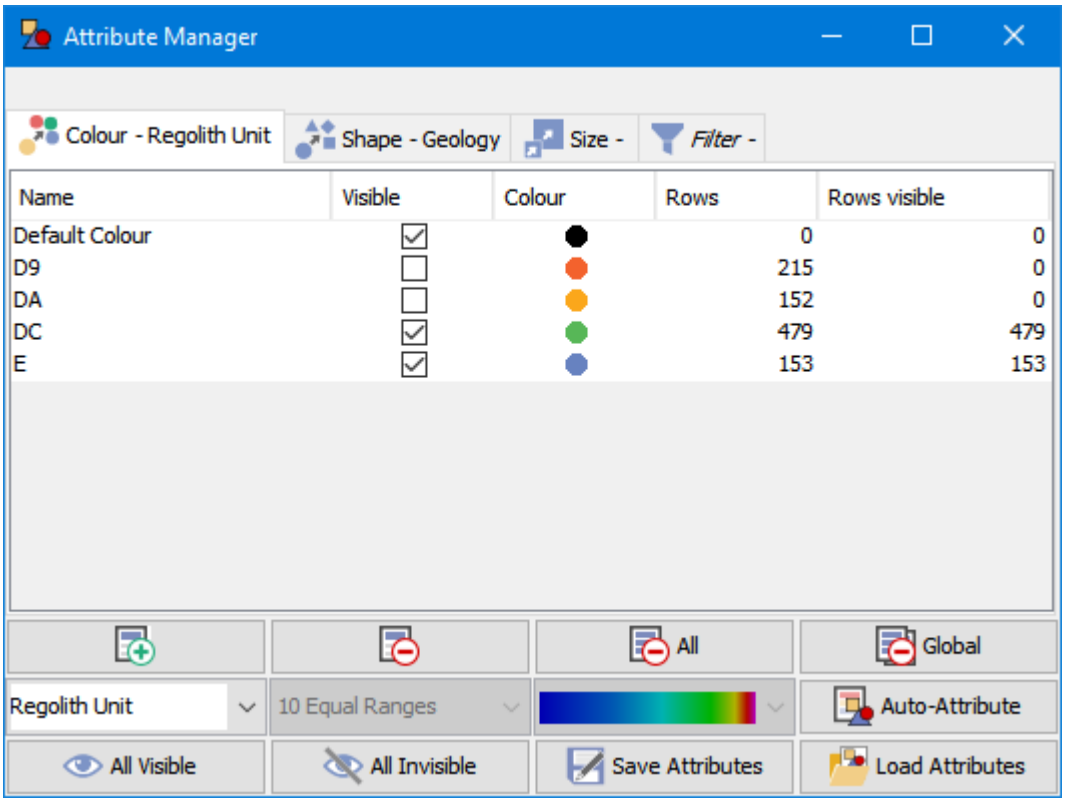


Change Visibility

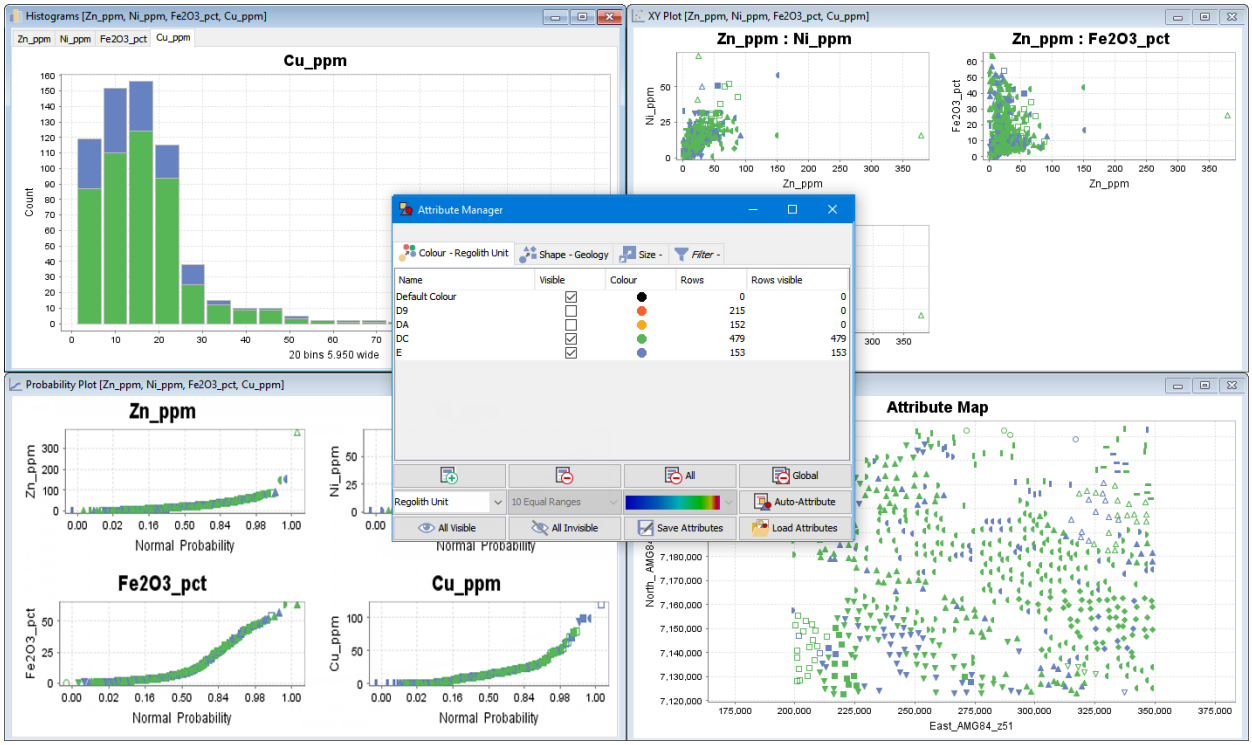
In the **Attribute Manager** it is possible to sub-set the data so that only data points from particular regolith units are displayed. This is controlled by the visibility options.

6. In the Colour tab, uncheck the box in the **Visible** column next to the **D9** and **DA** regolith groups. The rows visible column is set to 0 for these groups.

© Imdex Limited 2019



Observe how the data points are removed from all open plot windows.



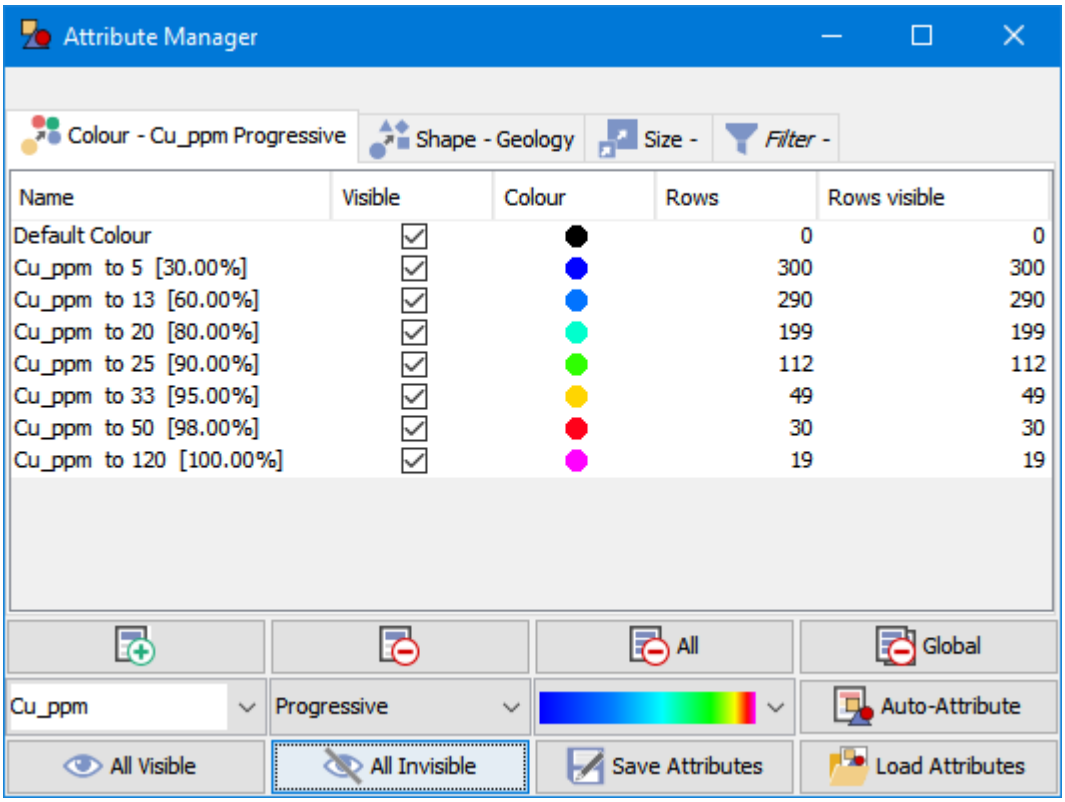
7. Click on **Save Checkpoint** in the Save band on the **Home** ribbon. Enter a name for the checkpoint such as **DC + E Regolith Units** and click OK.
8. Check the boxes to re-display the samples or click on the **All Visible** button at the bottom of the **Attribute Manager** window.

Auto-Attribute Numeric Data

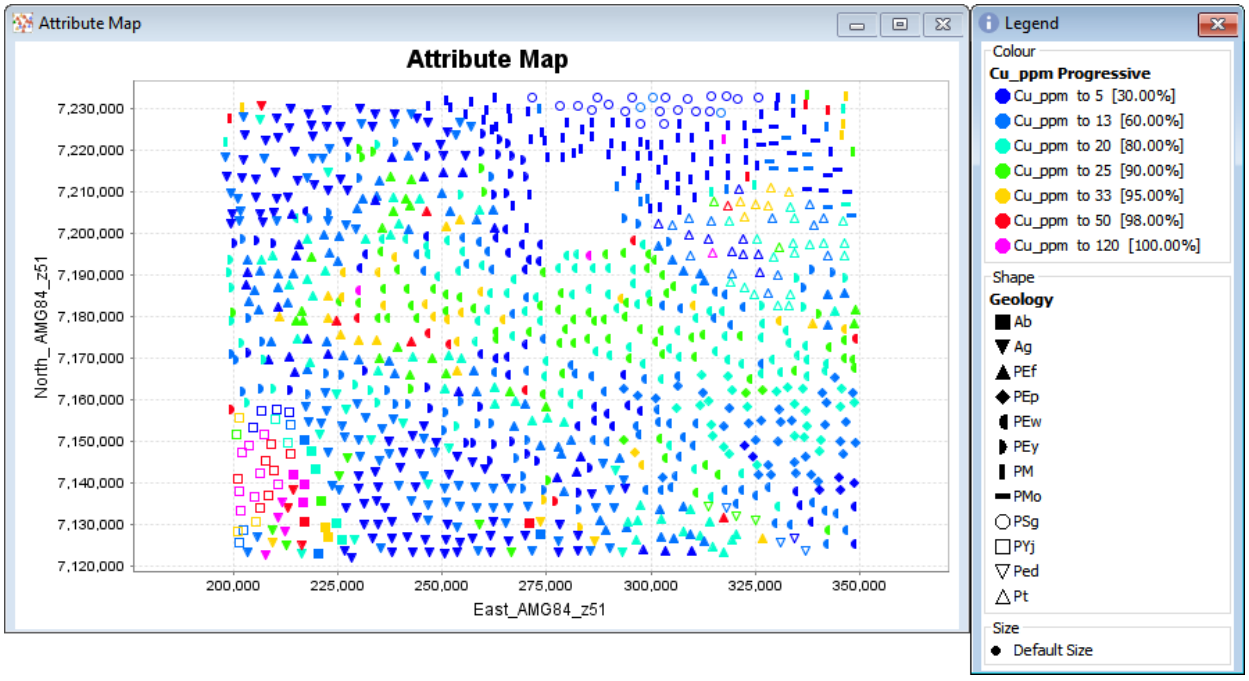
Auto- Attributing can be used to apply attributes to data based on data percentiles/custom ranges for numeric columns. For numeric data columns, data points are attributed according to a selected percentile binning range, e.g. 5 or 10 equal ranges, Quartile, Progressive, etc and then coloured using one of the supplied colour ramps. It is also possible to create custom bin ranges rather than percentiles which can be applied to different datasets.

9. While still in the **Colour** tab select a numeric variable column such as **Cu_ppm** from the column pull-down list.
10. Click on the down arrow next to **10 Equal Ranges** and select **Progressive** from the binning range pull-down list. The Progressive binning range divides the data into percentiles based on 30, 60, 80, 90, 95 and 98% cut-offs.
11. Click on the arrow next to the colour ramp and look at the available options. Use the default **ioGeochem Non-linear** colour ramp at the top of the list.
12. Click **Auto-Attribute** to apply the colours and select **YES** to overwrite the existing colour attributes.

© Imdex Limited 2019

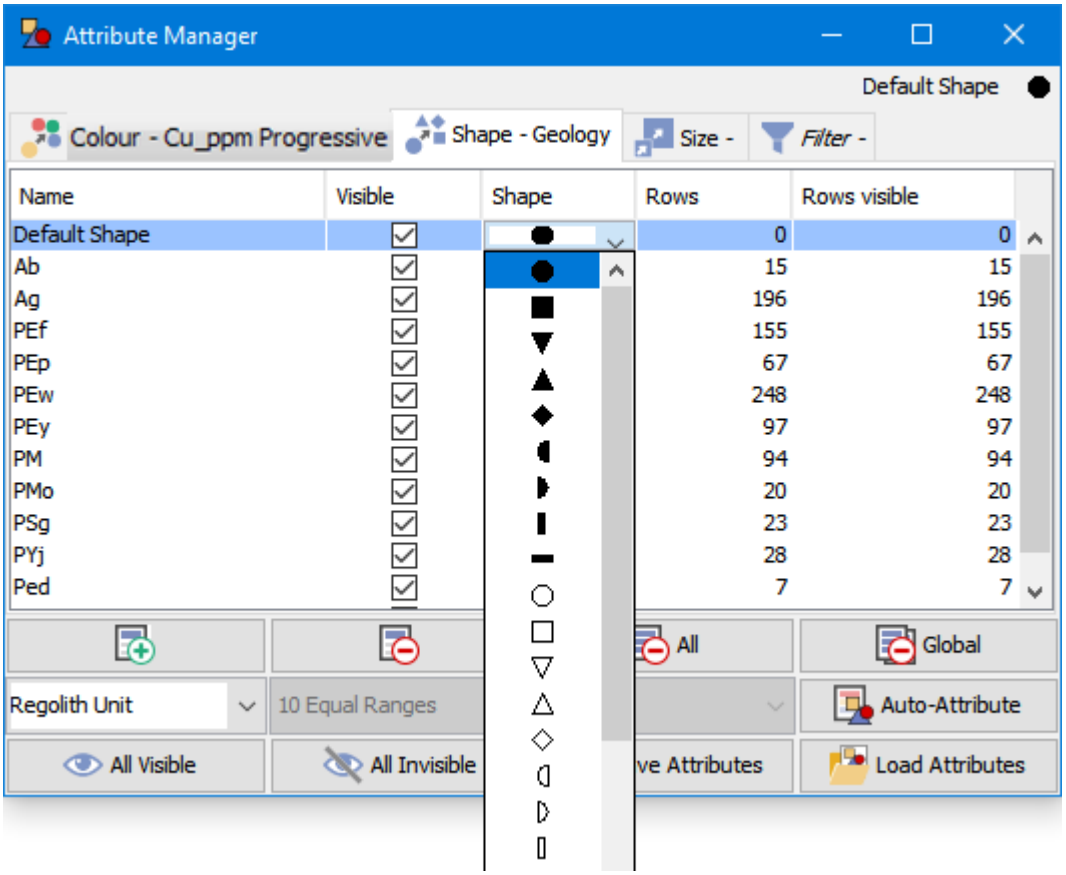


13. Observe how the values are updated in the **Legend**.



14. To change the assigned colour/shape/size of an attribute double-click on the attribute (e.g. red circle, square, etc) and select a different one from the colour palette or drop-down list (for shape/size).

© Imdex Limited 2019



15. Attributes can be combined by dragging one group onto another group, e.g. drag the Geology group PMo onto PM to create a combined group named PM + PMo.
16. It is also possible to change the name of an attribute by double-clicking in the **Name** column and overwriting the entry with a new one. Any changes are displayed in the **Legend** window but are not written back to the dataset.

Remove Attributes

17. Highlight the **PEw** entry in the **Shape** tab. To remove this entry from the list use the  button. All of the PEw samples now show the **Default Shape**.
18. To remove all the **Shape** attribute entries click on the 

button. All samples now show the **Default Shape**.
19. To remove all the currently applied colour/shape and size attributes click on the 

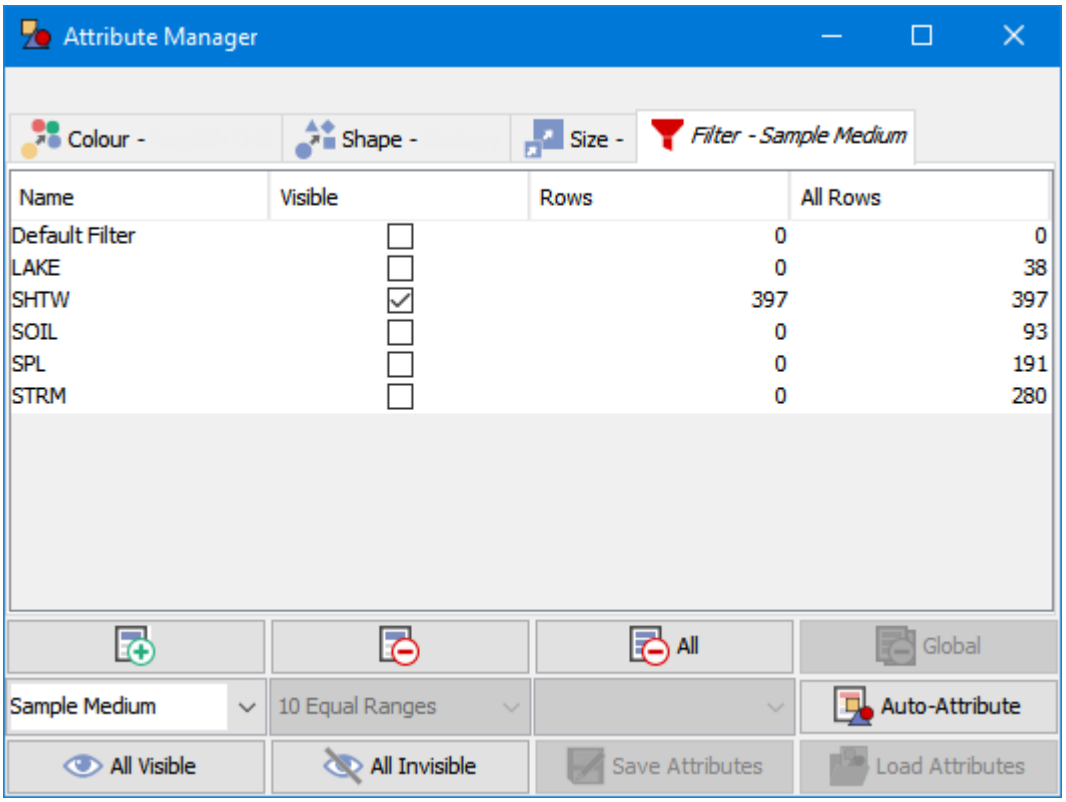
button.

© Imdex Limited 2019

Attribute Filter

The Attribute Manager **Filter** is a way to create a subset of data to work with in ioGAS™ without having to open up a new file. Applying a data filter enables only data points that fit the filter criteria to be displayed in any open plot windows.

20. In the Attribute Manager click on the **Filter** tab.
21. Choose **Sample Medium** from the drop-down list and click the **Auto-Attribute** button.



22. Turn off the visibility for all of the groups, leaving only the 397 **SHTW** samples.
23. Click on **Save Checkpoint** in the Save band on the **Home** ribbon. Enter a name for the checkpoint such as **SHTW Samples** and click OK.
24. Experiment with **Auto-Attributing** data using different text columns and also with numeric columns using different colour ramp/binning combinations.

    Observe how the colour, shape and size attributes are only applied to the filtered SHTW samples.
25. **Filter** attribute entries can be removed by clicking on the  or  buttons. Note that if any filter is active (i.e. some rows are

© Imdex Limited 2019

excluded from the dataset using a filter), the icon on the Filter tab will be red instead of blue.

It is possible to attribute data by applying the same variable to the colour, shape and size attribute tab or apply three different variables.

Attribute Manager Window

The **Attribute Manager** window can be dragged outside of the application if dual screens are setup to keep the Attribute Manager window open all the time. Alternatively, select **External Windows Always on Top** from the  **Settings** drop-down menu to keep the Attribute Manager displayed on top of other plot windows instead of minimising.

© Imdex Limited 2019

11. Make Data Selections

The **Attribute Manager** can also be used to assign colours, symbols or different sizes to manually selected data points in a plot window.

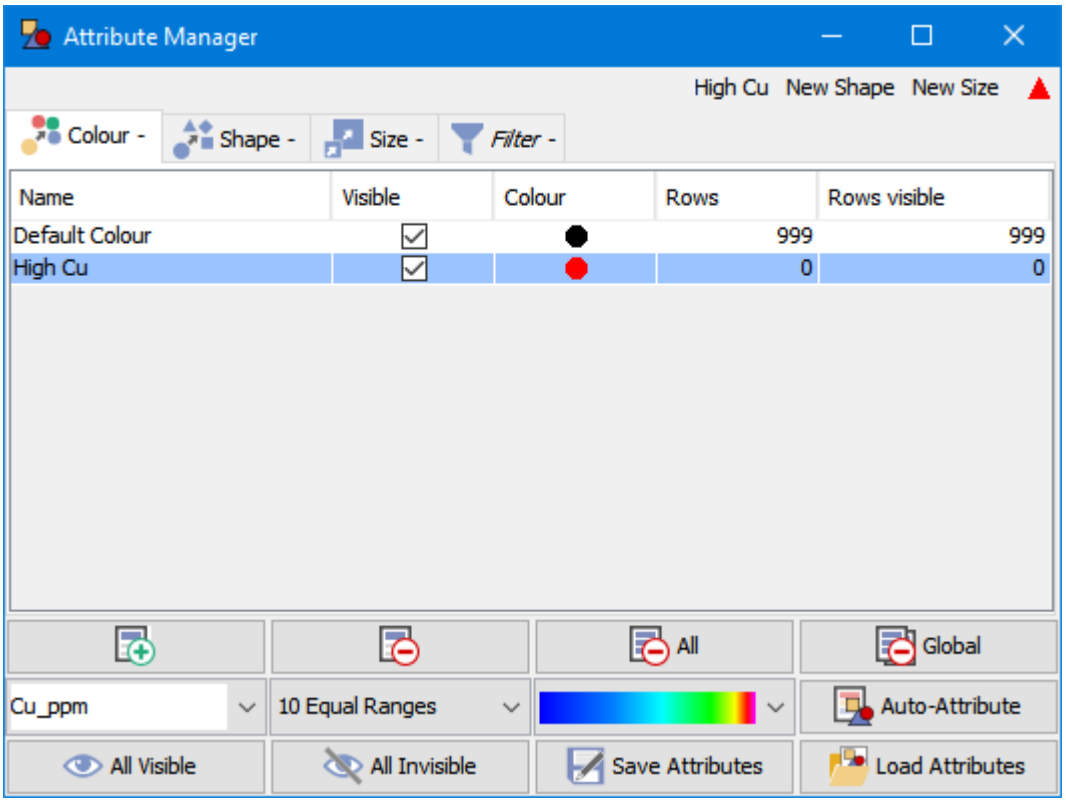
1. Select  **Attribute Manager** from the Tools band on the **Home** ribbon or use the Ctrl-A keyboard shortcut.
2. Remove any existing filters and/or attributes using the 

and 

buttons.
3. Select the **Colour** tab and click on the **Add an Attribute**  button. A new colour row is added under the default colour row and is coloured red.
4. Double-click on the **New Colour** entry to assign a name for the attribute (ie. High Cu) and then click **Enter**. Make sure that the **High Cu** row is highlighted (in blue) and that a red circle with "High Cu" is also displayed in the top right of the Attribute Manager window.
5. Select the **Shape** tab and click on the **Add an Attribute** button. Change the shape to a **triangle**. Select the row so it is highlighted in blue.
6. Repeat the process in the **Size** tab by making a new entry with a size of **10** and selecting this row.

   The shape and size attributes should display in the top right corner as **New Shape** and **New Size** when they are highlighted correctly.

© Imdex Limited 2019



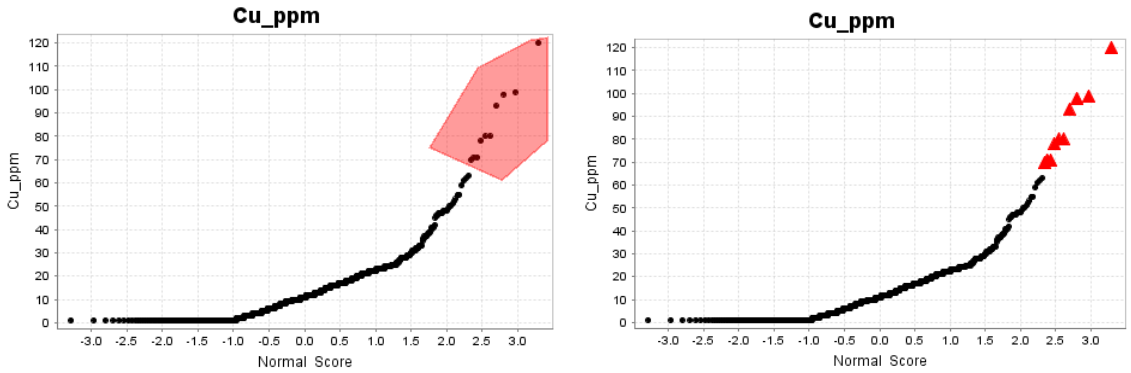
7. Click in the **Probability Plot** window created back in **Step 9**.

   Otherwise, click on the **Probability Plot** on the **Home** ribbon again if the plot window has been closed. Re-size this window to make it bigger and make sure the Probability toolbar is visible by clicking in the plot window to make it active.

8. Select **Attribute Polygon** from the toolbar.

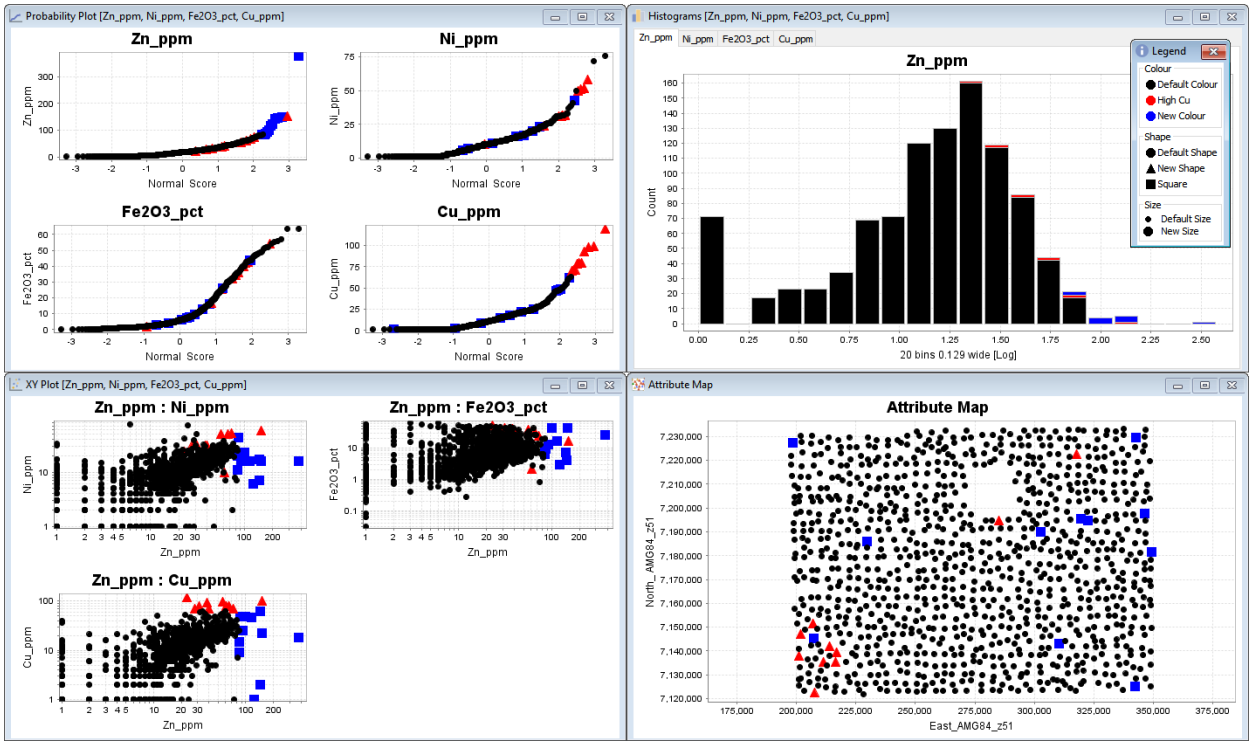
9. In the **Cu_ppm** probability plot window, hold down the left mouse button and click around the high values in the plot window to create a polygon (region) object. Double-click to finish.

   All of the data points within the polygon should now be attributed with a red triangle 10 pt in size.



10. Select **Tile** from the Window band to view all the open plot windows. Observe the red triangle attributed points in the other plot windows. The **Legend** window is also updated.
11. Leaving the High Cu samples attributed, repeat the process outlined above to make another selection on the probability plot using a blue square 10 pt combination. Assign a name for the new group in the colour tab.

    Make sure that blue colour, square shape and Size 10 pt attributes are highlighted in their respective tabs and displayed in the **Attribute Manager** top right corner prior to making the data selection.
12. Drag the Probability Plot window to make it bigger and then zoom in on the Cu_ppm probability plot to show the samples with values below the red triangles. Using the **Attribute Point** tool click on individual points to attribute them as blue squares. Observe how the samples are updating in the other probability plot windows.



12. Select **Data** and left-mouse click in the **[Colour]** column header cell twice to display the data in descending order based on colour. Observe how the colour, shape and size attributes have been updated next to each row.

13. Click on **Save Checkpoint** in the Save band on the **Home** ribbon. Enter a name for the checkpoint such as **High Cu samples** and click OK.
14. Open the **Attribute Manager** again if it has closed (Ctrl-A) and remove all attributes using the 

Global button. Experiment with creating different colour, shape and size attribute combinations and applying them to data selections. View the results in the data table.
15. Close all plots at the completion of this exercise using **Close All** on the Window band or use the Ctrl-Shift-W keyboard shortcut.

© Imdex Limited 2019

12. Univariate Statistics

When analysing data it is useful to look at various statistical parameters for either the entire dataset or for selected categories within a dataset. The selected categories are based on the colour groups as set in the **Attribute Manager**.

Summary Statistics

1. Open an  **Attribute Map** from the **Home** ribbon.
2. Open the  **Attribute Manager** using the button or Ctrl-A and remove any existing attributes. Click on the **Colour** tab and auto-attribute the data using the **Regolith unit** column.
3. Select  **Summary Stats** from the Stats band on the **Home** ribbon.

© Imdex Limited 2019

Summary Statistics - Univariate [Zn_ppm, Ni_ppm, Fe2O3_pct, Cu_ppm]

999 rows - Univariate	Zn_ppm	Ni_ppm	Fe2O3_pct	Cu_ppm
[Visible] : Count Numeric	999	999	999	999
[Visible] : Count Text	0	0	0	0
[Visible] : Count Null	0	0	0	0
[Visible] : Count Negative	0	0	0	0
[Visible] : Count Zero	0	0	0	0
[Visible] : Unique Values	86	44	773	63
[Visible] : Minimum	1	1	0.03	1
[Visible] : Maximum	379	76	63.71	120
[Visible] : Mean	21.563564	10.877878	10.554505	13.427427
[Visible] : Median	18	10	6.06	11
[Visible] : Range	378	75	63.68	119
[Visible] : Interquartile Ra...	20	9	10.89	15
[Visible] : Standard Deviati...	21.918727	8.199608	11.658192	12.988684
[Visible] : 1 percentile	1	1	0.4	1
[Visible] : 5 percentile	1	1	1.1	1
[Visible] : 10 percentile	3	1	1.47	1
[Visible] : 25 percentile	8	5	2.75	4
[Visible] : 75 percentile	28	14	13.64	19
[Visible] : 90 percentile	44	20	28.27	25
[Visible] : 95 percentile	56	25	36.64	33
[Visible] : 99 percentile	87	39	51.36	70
D9 : Count Numeric	215	215	215	215
D9 : Count Text	0	0	0	0
D9 : Count Null	0	0	0	0
D9 : Count Negative	0	0	0	0
D9 : Count Zero	0	0	0	0
D9 : Unique Values	36	24	177	26
D9 : Minimum	1	1	0.06	1
D9 : Maximum	145	76	43.42	70
D9 : Mean	10.162791	6.065116	5.532186	5.009302
D9 : Median	6	4	2.3	2
D9 : Range	144	75	43.36	69
D9 : Interquartile Range	8	7	3.62	5
D9 : Standard Deviation	17.718371	7.539023	8.21263	8.347584
D9 : 1 percentile	1	1	0.0976	1
D9 : 5 percentile	1	1	0.66	1
D9 : 10 percentile	1	1	1.006	1
D9 : 25 percentile	3	1	1.43	1
D9 : 75 percentile	11	8	5.05	6
D9 : 90 percentile	19	13	15.394	12
D9 : 95 percentile	29.2	17	27.718	18

In the **Summary Statistics** window all of the selected variables are displayed along with a number of basic statistics for each regolith group. The values in each group are also coloured according the colours in the Attribute Manager.

The values at the top in black are the calculated statistics for all visible data regardless of colour group as denoted in the Attribute Manager.

5. To change the displayed statistics click on **Choose Statistics** on the Summary Statistics toolbar. Check or uncheck the statistics as required and click **Apply** to

© Imdex Limited 2019

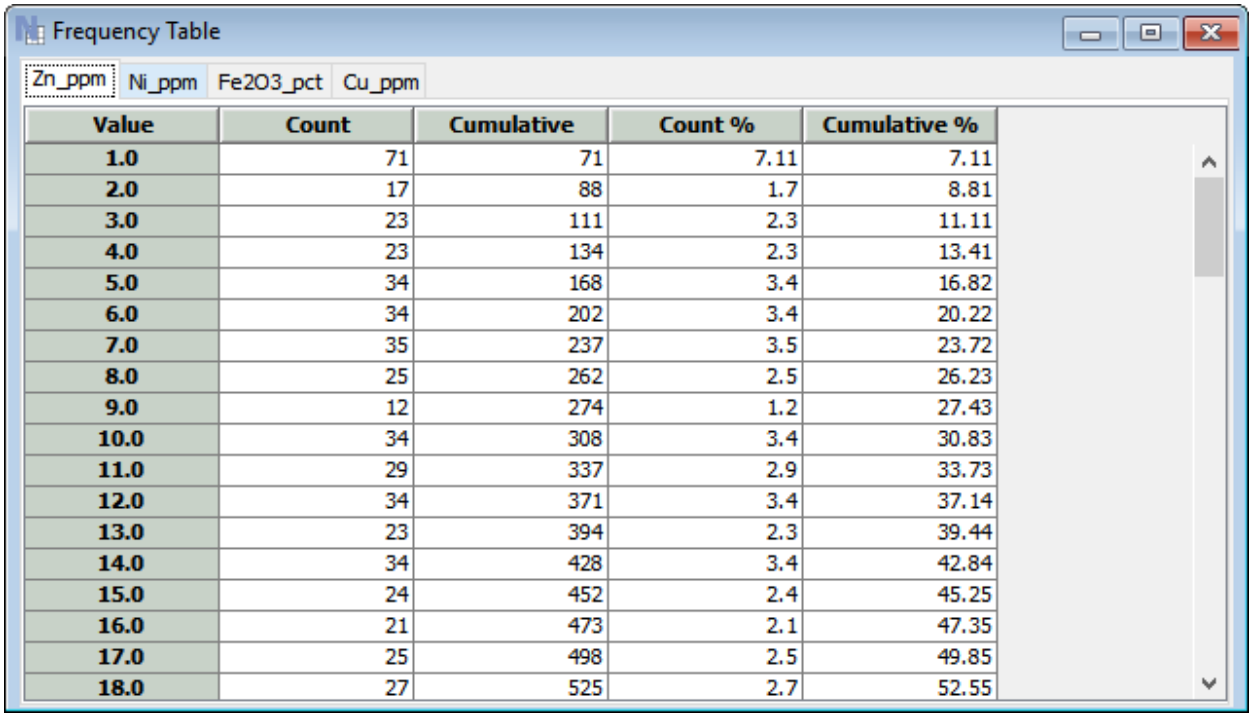
update.

6. Click on **Change Grouping** on the toolbar to group the data by statistic rather than by group.
7. Close the **Statistics** window using the **X** in the top left hand corner when complete.

Frequency Table

View all the unique values for each selected variable and the counts for each using a Frequency Table.

1. Select **Display Frequency Table** from the **Summary Stats** drop-down menu on the **Home** ribbon.
2. Each variable is displayed in a separate tab.



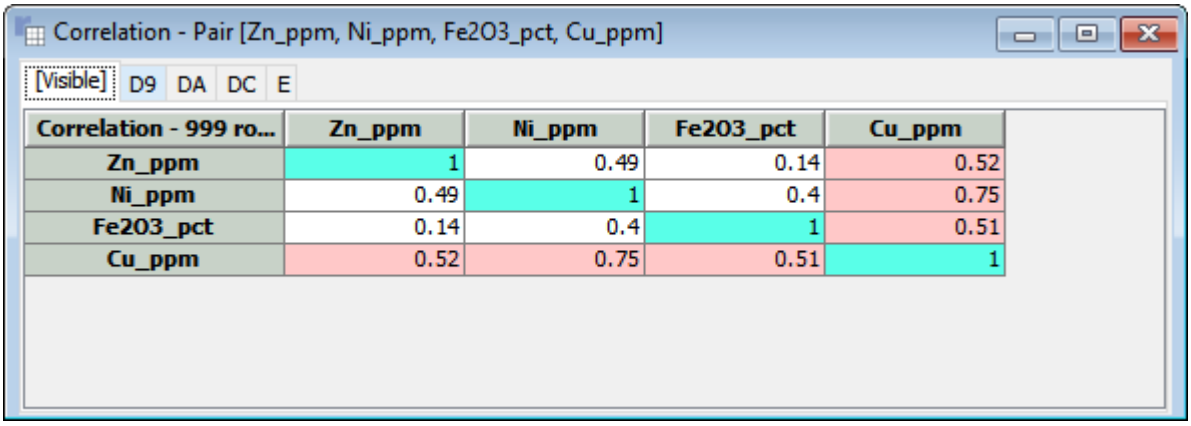
Value	Count	Cumulative	Count %	Cumulative %
1.0	71	71	7.11	7.11
2.0	17	88	1.7	8.81
3.0	23	111	2.3	11.11
4.0	23	134	2.3	13.41
5.0	34	168	3.4	16.82
6.0	34	202	3.4	20.22
7.0	35	237	3.5	23.72
8.0	25	262	2.5	26.23
9.0	12	274	1.2	27.43
10.0	34	308	3.4	30.83
11.0	29	337	2.9	33.73
12.0	34	371	3.4	37.14
13.0	23	394	2.3	39.44
14.0	34	428	3.4	42.84
15.0	24	452	2.4	45.25
16.0	21	473	2.1	47.35
17.0	25	498	2.5	49.85
18.0	27	525	2.7	52.55

Correlation Matrix

Display the correlation coefficient values for each paired combination of selected variables.

1. Select **Correlation Matrix** from the **Analysis** ribbon.

© Imdex Limited 2019



Correlation - 999 ro...	Zn_ppm	Ni_ppm	Fe2O3_pct	Cu_ppm
Zn_ppm	1	0.49	0.14	0.52
Ni_ppm	0.49	1	0.4	0.75
Fe2O3_pct	0.14	0.4	1	0.51
Cu_ppm	0.52	0.75	0.51	1

Highly positive or negative correlated pairs of data are coloured in pink and red. The first tab shows the correlation values for all of the visible data selected in the Attribute Manager. The other tabs show the correlation values for each colour attribute group.

Summary statistics and Frequency Table can also be accessed via the Analysis ribbon.

© Imdex Limited 2019

13. Variable Maps and Gridding

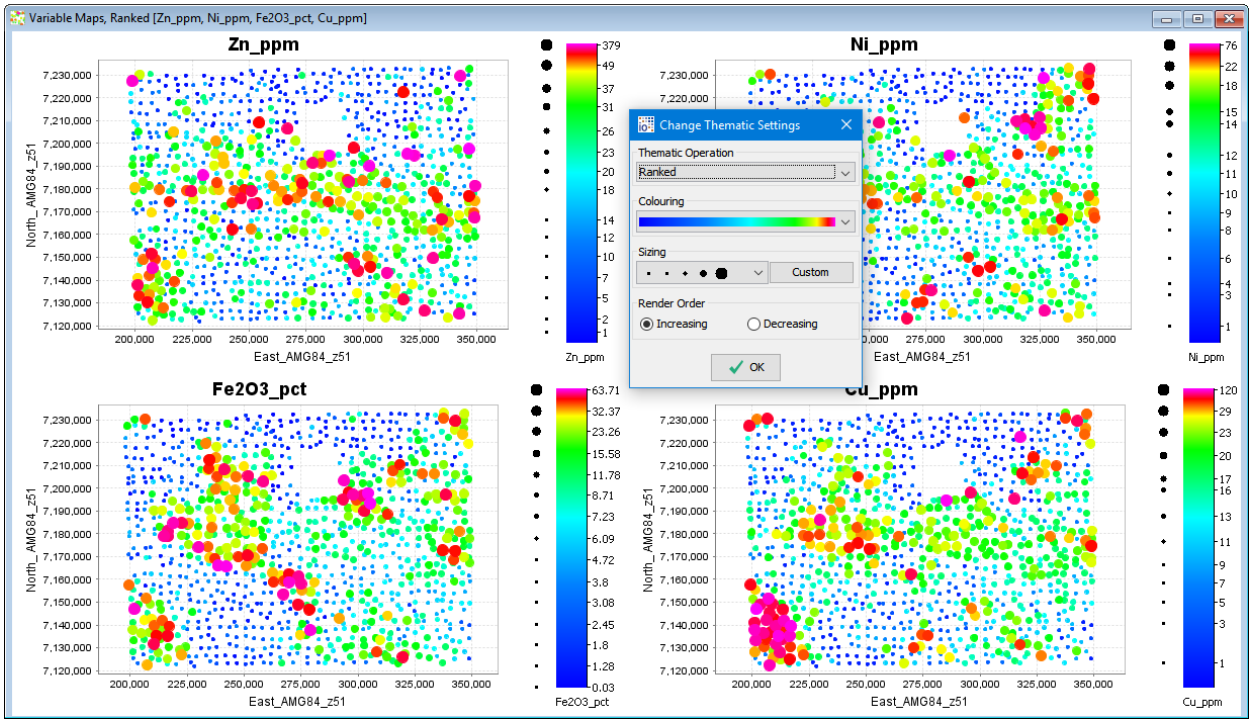
Variable maps and gridding are ioGAS™ **Map** tools, in addition to **Attribute Maps**. The data in these plots is displayed spatially and can be exported for use in GIS applications.

Variable Maps

A **Variable Map** displays each of the selected variables in a separate map view. The data points in each map are displayed using one of the pre-defined thematic operation, colour and size ramping options. Variable maps are good for comparing high or low concentrations across multiple elements.

1. Select  **Settings>Normal Windows** from the Window band if it is not already selected.
2. Select  **Variable Map** from the **Home** ribbon.
3. By default the data for each variable is displayed according to its ranked percentile. To view what data values are represented by their colour and size attributes click on  **Show/hide colour bar legend** on the variable map toolbar.
4. Click on  **Save Checkpoint** in the Save band on the **Home** ribbon. Enter a name for the checkpoint such as **Ranked Variable Maps** and click OK.
5. To modify the thematic settings click on  **Change thematic settings** on the variable map toolbar.

© Imdex Limited 2019



In addition to the ranked thematic operation, all of the other available binning ranges in the Attribute Manager can also be used in the variable maps, for example, quartile, progressive half, equal tails 6 groups, etc. Custom bin ranges can also be selected here.

6. Experiment by selecting other thematic operations and observing the legend and data points automatically updating.
7. Select from a number of different Colour and Size ramps and observe how the data appearance changes. To see what type of size ramp is being applied place the cursor over the entry in the pull-down list. Repeat for the colour ramps.

   With the exception of the ranked thematic operation, all other binning ranges can be coloured using continuous colour ramps or discrete colours.
8. Close all variable map windows upon completion of this exercise.

Export Variable Maps

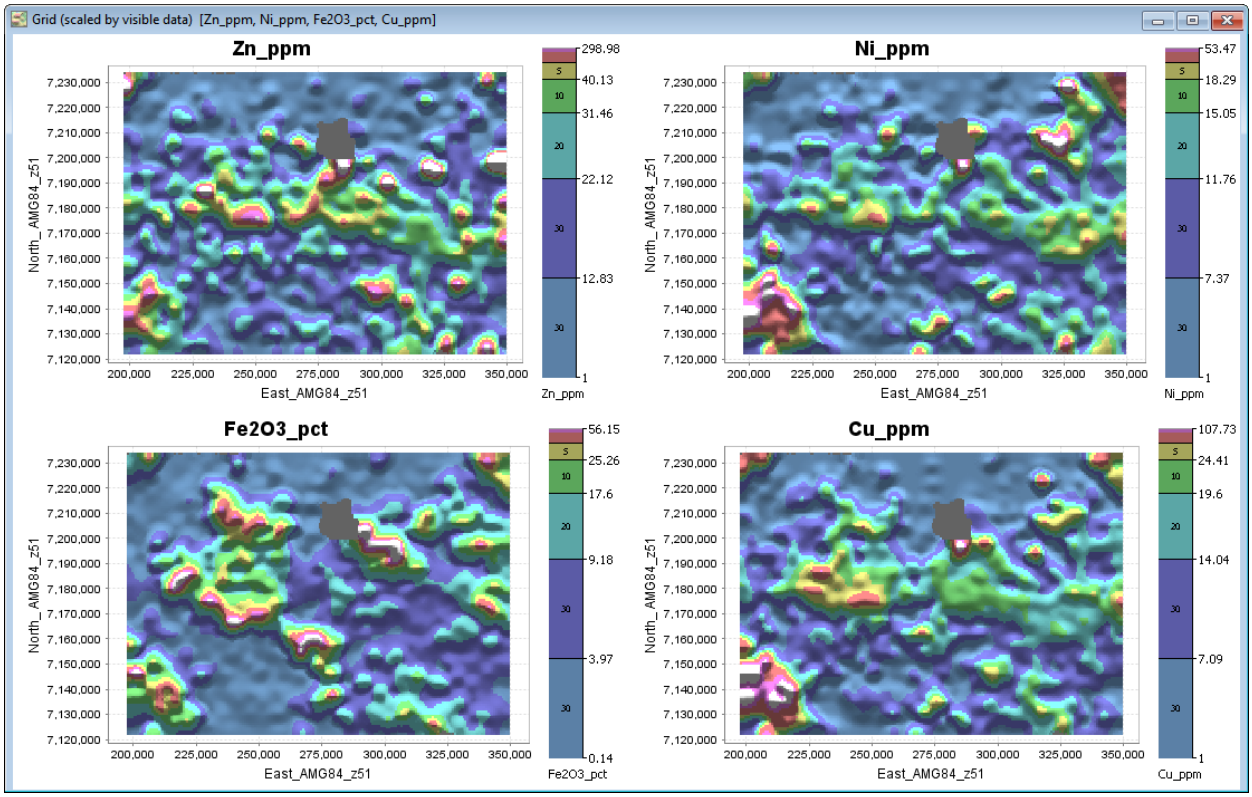
Variable maps can be exported and viewed in Google Earth and MapInfo.

Gridding

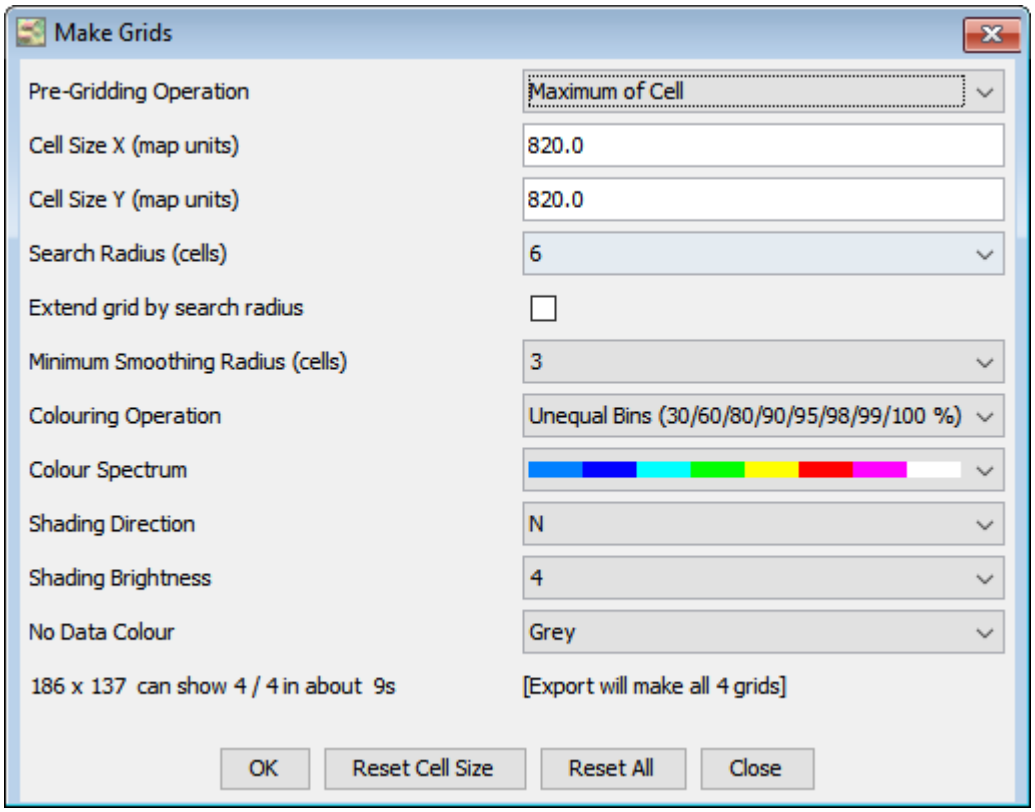
A grid is created from the interpolation of located data onto a regular grid or matrix that is then rendered so that it can be viewed as a continuous coloured or shaded surface. ioGAS™ includes a gridding tool that uses a modified Inverse Distance Weighting algorithm to generate the interpolated grid cell values.

© Imdex Limited 2019

Only one grid window can be displayed in ioGAS™ at a time.



1. Select  **Grid** from the **Home** ribbon.
2. The **Make Grids** dialog is displayed.



ioGAS™ attempts to automatically select the appropriate grid cell size settings for the dataset based on an algorithm that analyses the spatial structure of the data. All of the other gridding parameters including grid cell size, search radius, smoothing, etc. can be customised.

3. Leave the default settings and click **OK**. The grids are displayed in a single plot window.
4. To view the grid cell values that the colours represent click on **Show/hide grid legend** on the gridding toolbar.
5. Overlay the attribute points on top of the grid using **Show/hide attribute map**.
6. Place the cursor over the grid and use the zoom tools (or mouse scroll bar) to zoom all the grids together at the cursor location.
7. To change the grid parameters select **Display grid options** from the toolbar.
8. Close the grid window upon completion of this exercise.

Export Grids

The gridded images can be exported using the **GeoTiff** and **ER Mapper Grid** export options on the gridding toolbar.

Variable Maps and Grids can also be accessed via the Map ribbon.

© Imdex Limited 2019

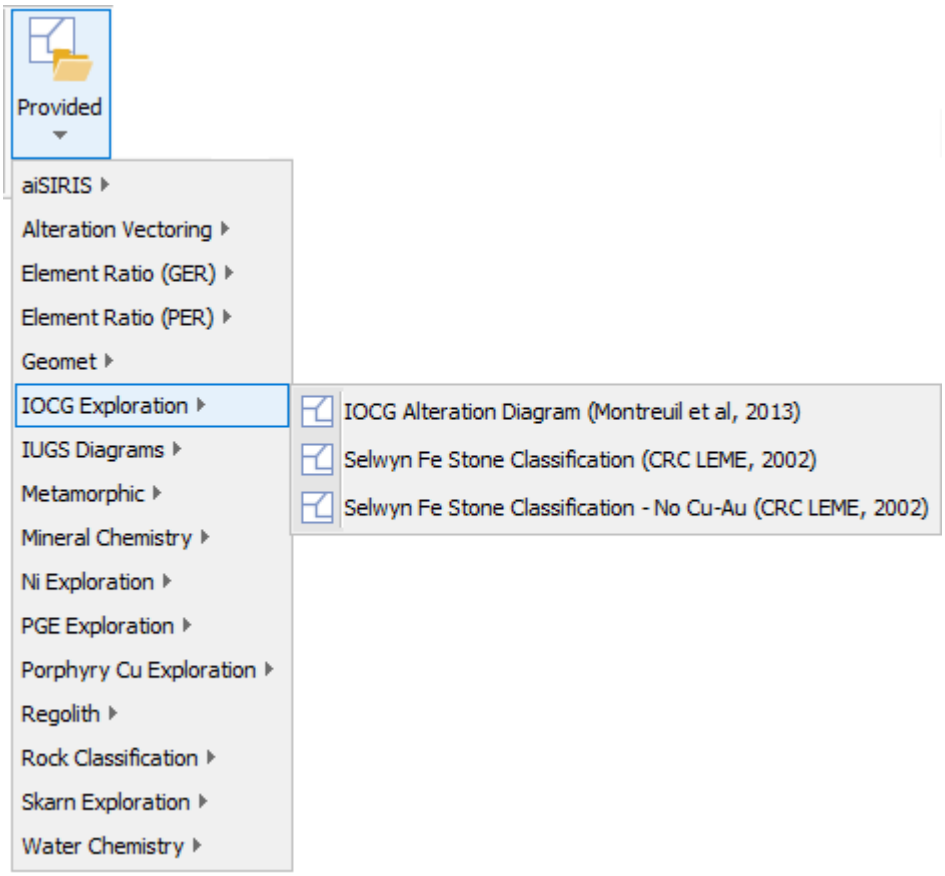
© Imdex Limited 2019

14. Diagrams, Spiders & Calculations

ioGAS™ contains a number of standard classification diagrams arranged into a logical menu system. Data can be plotted on classification diagrams and then attributed according to the classification group in which they are located. These attributes can be written back to the file and used in further analysis or exported for use in third-party programs.

In order to view data on a supplied classification diagram the variable columns must be "aliased" in the **Column Properties** dialog as outlined in **Step 3**. This is so ioGAS™ can perform any element/oxide/unit conversions to get the data into the correct format to display on the diagram.

The diagrams are located under **Provided** on the **Diagram** ribbon and are arranged into a series of sub-menus:

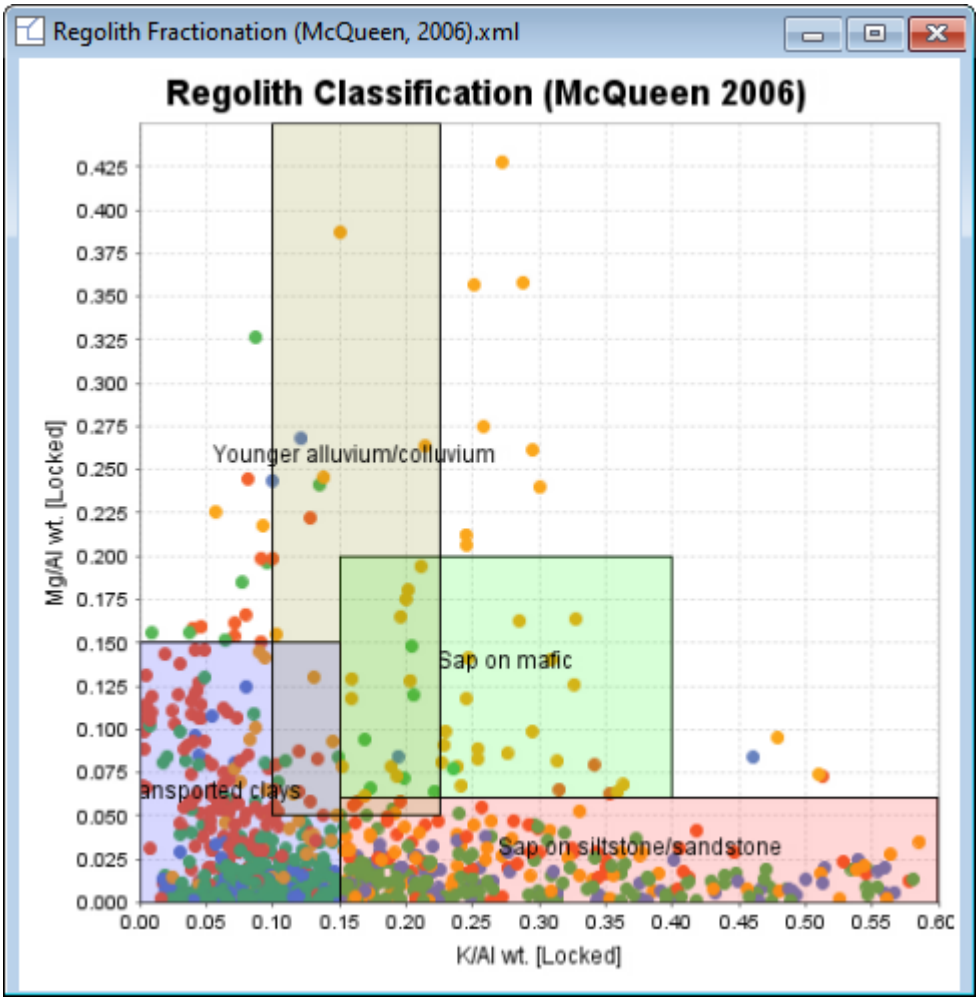


To view the diagram supporting information from within the **Diagram>Provided** menu hover the cursor over the menu item. If a diagram is greyed out then it means that one or more variables is not present in the dataset. The missing variable(s) are displayed in the tooltip when the cursor is hovered over the entry.

© Imdex Limited 2019

This exercise displays the demonstration dataset on a Regolith diagram that plots K/Al vs Mg/Al wt values to classify regolith data into transported clays, saprolite and younger alluvium/colluvium.

1. In **Provided**, navigate to **Regolith>Classification** and select the **Regolith Fractionation (McQueen, 2006)** diagram.

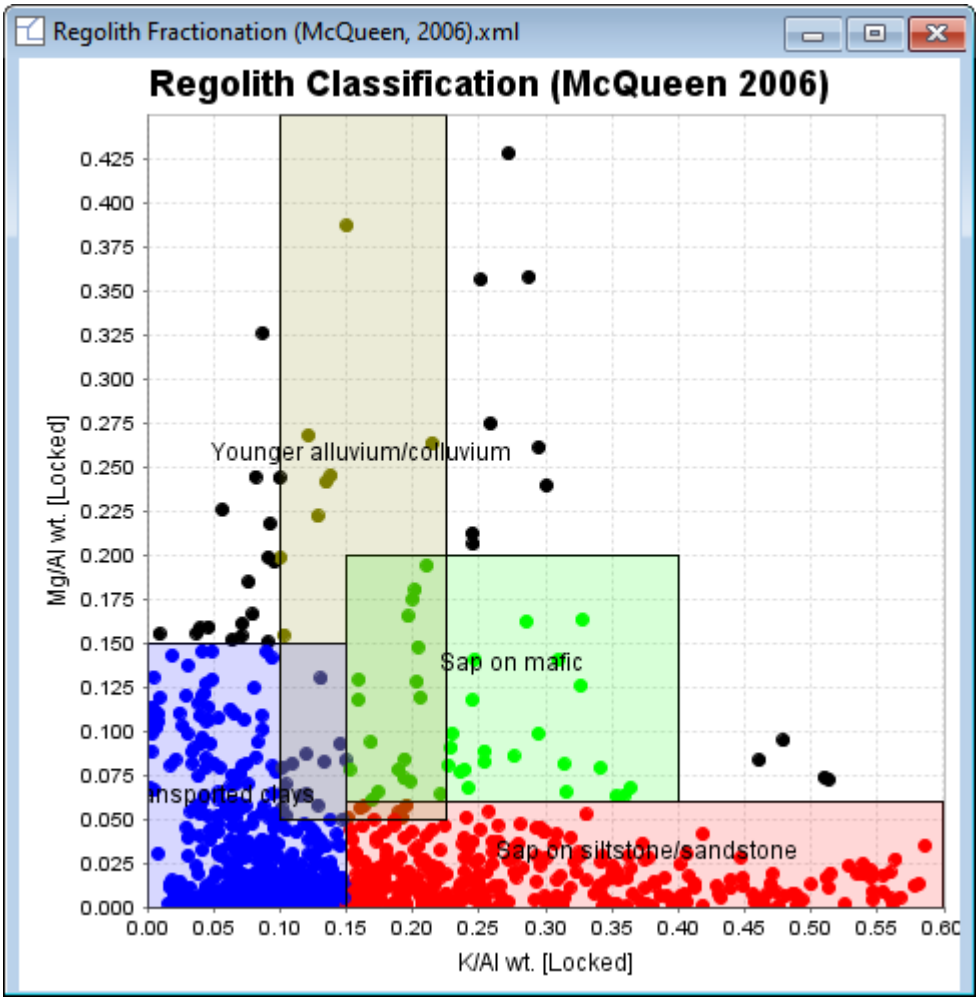


The data are plotted with the current attributes onto the diagram in a new plot window. The diagram window contains zooming, panning and selection tools the same as found on other plot toolbars.

2. Zoom out to see that not all the data plots within the diagram extents.
3. Right-mouse click and select **Zoom to Diagram** from the pop-up menu to return to the original diagram view.

© Imdex Limited 2019

4. To attribute the data points with the regolith classification group colours select **Colour Rows from Polygon** on the diagram toolbar and select "YES" to overwrite existing colour attributes.



5. Open the **Attribute Manager** to view the new colour groups based on the diagram classifications. Any samples that fall outside the diagram boundaries are coloured using the default colour black.
6. To make a new variable column which contains the regolith classification group for each row select **From Colour** from the Make Variables band on the **Data** ribbon.
7. Leave the default column name and click **OK**.
8. Open up a tabular view of the data using **Data** and scroll to the right to see the newly added columns.

   One column is text with the rock classification based on the polygon name; the other column is numeric with a different number for each rock classification.

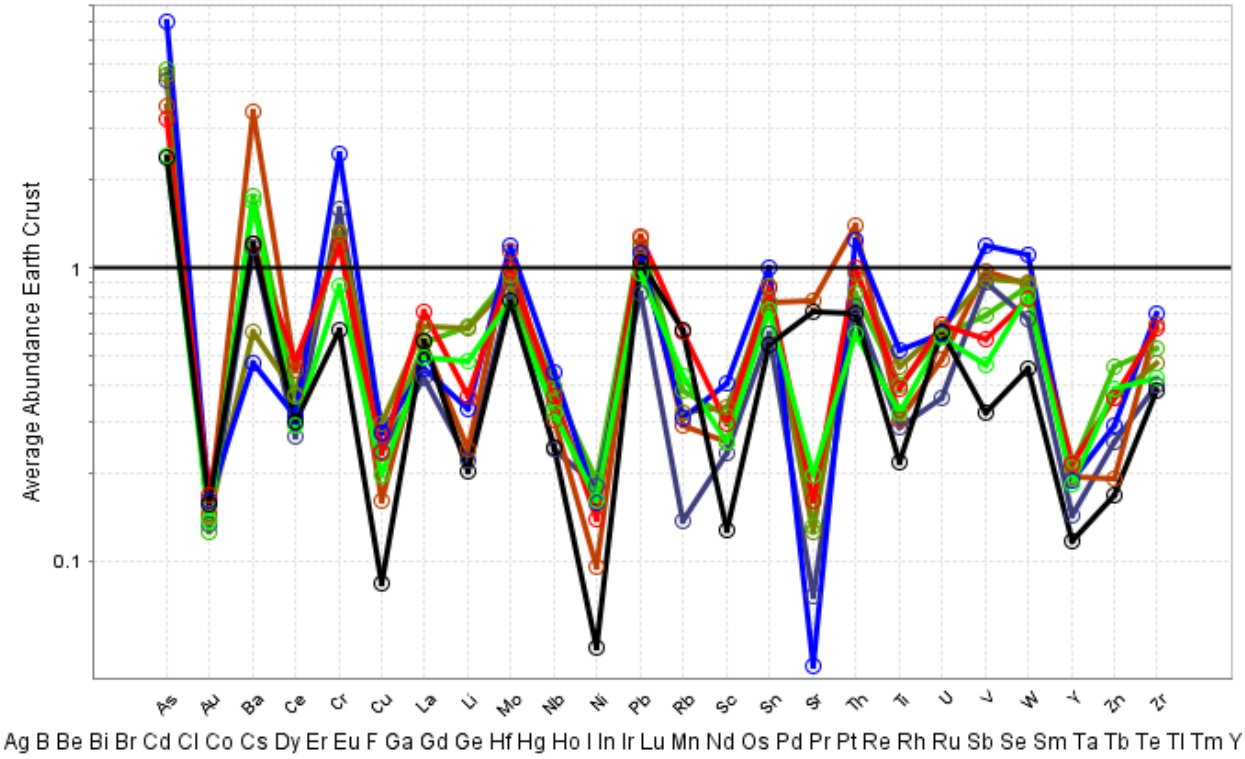
It is possible to make and edit your own classification diagrams and share them with others within your organisation.

Other Provided Resources

Aside from classification diagrams, ioGAS™ also provides a library of commonly used spider normalisations and calculations under the **Calculation** and **Spider** ribbons respectively.

Spider Plots

1. Click on the Spider tab to open the ribbon toolbar.
2. In **Provided**, navigate to **Crust** and select the **Av Abundance Earth Crust** spider.



3. Use **Make variables from spider** on the Spider toolbar to add normalised values for each element to the dataset as new columns.
4. Open up a tabular view of the data using **Data** and scroll to the right to see the newly added normalisation columns.

© Imdex Limited 2019

Calculations

1. Click on the Calculation tab to open the ribbon toolbar.
2. In  **Provided**, navigate to **Regolith** and select the **Chemical Index of Alteration (CIA)** calculation.
3. Open up a tabular view of the data using  **Data** and scroll to the right to see the newly added CIA column.

Create Custom Diagrams, Spiders and Calculations

In addition to the provided resources, users can create their own classification diagrams, spider normalisations and calculations.

© Imdex Limited 2019

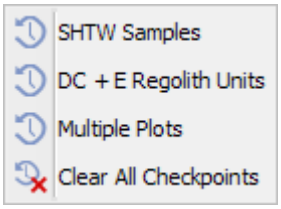
15. Checkpoints and Templates

Save and Restore Checkpoints

During this tutorial we have been saving a number of checkpoints. A **Checkpoint** is a saved snapshot of an ioGAS™ work session taken at a particular point in time and contains information about all of the open plot windows plus any other plot settings including the colour, shape, size, filter and visibility attributes displayed when the checkpoint was created.

Multiple checkpoints can be created and stored in a list for easy retrieval. At a later point in time a checkpoint can be selected from the list and the saved plot windows and attributes restored as the current work session, replacing the existing ioGAS™ display. Checkpoints are saved with the ioGAS™ file.

1. To restore a checkpoint select **Open Checkpoint** on the Open band of the **File** or **Home** ribbon. (This function is also available from the **Open** drop-down menu on other functional ribbons.)
2. All of the saved checkpoints appear in a drop-down list in creation order (newest on top):



3. Select **Multiple Plots** from the list and **Restore**.

   Observe how the current ioGAS™ session is replaced with the saved checkpoint windows and the saved attributes are also restored.
4. Restore the other saved checkpoints.

Checkpoints can be renamed or deleted. To remove all checkpoints select **Clear All Checkpoints**.

Templates

Templates enable groups of plots and customised settings to be saved and then restored with updated or new datasets. Templates can be created that represent standard workflows in your data analysis and can be shared with colleagues.

© Imdex Limited 2019

Templates work with aliased data so that if the exact element/oxide/unit used in the template is not present in the dataset but the element is available in another form, ioGAS™ can convert the data on-the-fly to the required combination.

A number of commonly used plot combinations have been created for you and are available in ioGAS™.

1. Go to  **Provided** in the **Open Templates** band in the **File** ribbon or alternatively from the  Open drop-down menu on any of the functional bands (Home, Data, Calculation, Analysis, etc.).
2. Select the **Alteration Plots** template. Hover the cursor over the template entry to view the contents.
3. In the **Choose** dialog select **Template**. This will use the stored plot axis ranges in the template when opening up the plot windows. The **Default** option will re-scale the axis ranges using the current dataset.

Templates do not replace the currently open plot windows so multiple templates can be open at the same time.

4. Use **Close All** on the Window band of the **Home** ribbon to close all windows.

Create Custom Templates

In addition to the provided resources, users can create their own templates.

16. Save, Copy, Export and Print Options

Save ioGAS™ File

1. Click  **Save** from any of the ribbons (other than Help).
2. Enter a name for the file and save to your desktop.

   The **Save** option saves both the current data and the attribute information as a native ioGAS™ file. Any open plot windows are also saved and will be re-opened when the file is next loaded. To re-open a native ioGAS™ file use the  **Open** menu option.

Save As ioGAS™ File

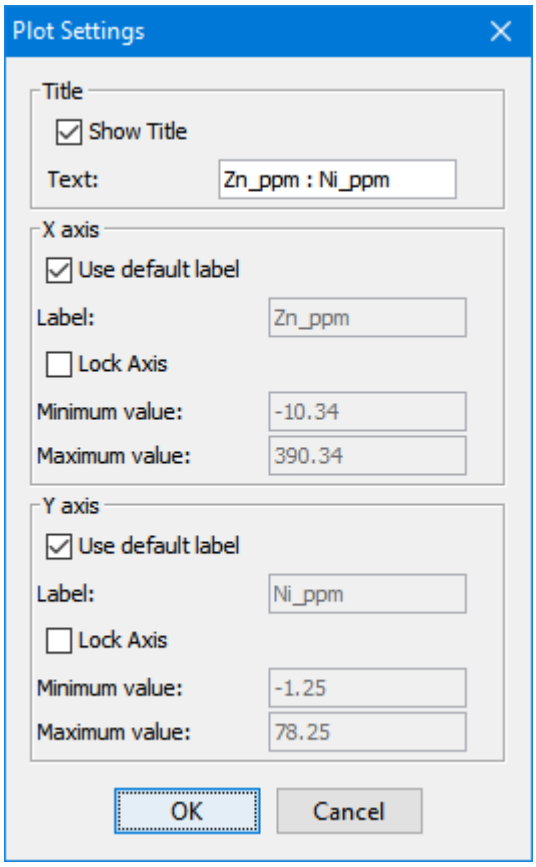
To save a copy of an ioGAS™ file select  **Save As** from the  **Save** drop-down menu and choose **ioGAS™ File** from the **Files of Type** pull-down list.

Copy Options

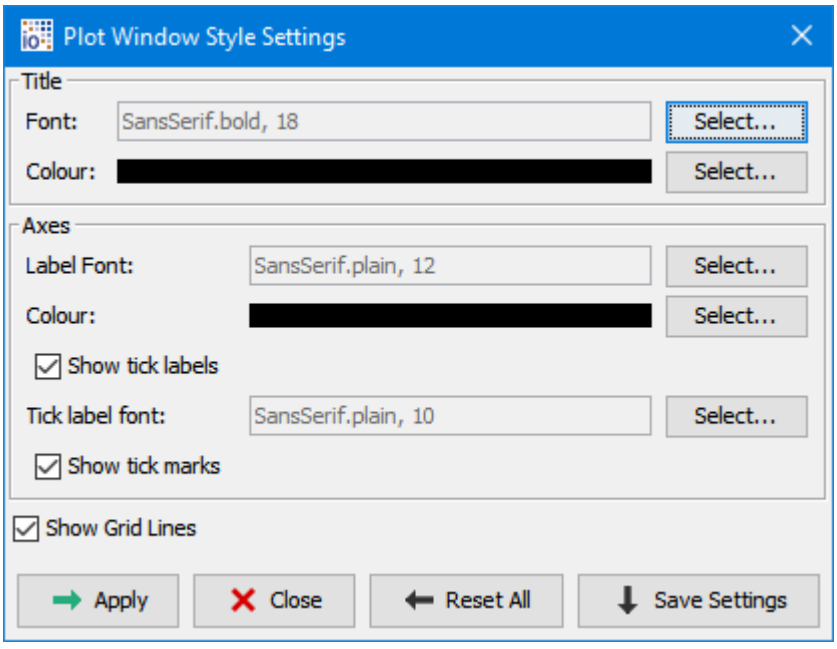
Before copying a plot window as an image or vector file you may want to modify some of the plot parameters such as plot title, axis ranges, label colours, etc. These parameters can be changed by one of two ways:

- **Plot Settings** - Affects individual plots only and includes options to show/hide plot title, change title text, show/hide axis labels, change axis label text and modify axis ranges. Right-mouse on an individual plot and choose plot settings from the pop-up menu.

© Imdex Limited 2019



- **Plot Window Style Settings** - Affects all plots in a window and includes options to change title and axis label font, colour and size, show/hide tick marks and labels, tick label font, colour and size and show/hide gridlines. Click on **Plot Window Style Settings** on selected toolbars to access this dialog:



Copy Window as Image

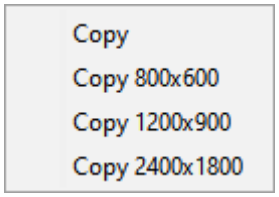
This option creates a bitmap image of the active window and copies it to the clipboard.

1. Use the Ctrl-C keyboard shortcut (Windows)/Command-C (Mac) or click **Copy Window** on the File or Home ribbons.
2. Paste into a third-party program such as Word, PowerPoint or image processing package using right-mouse click + **Paste** or Ctrl-V (Windows)/Command-V (Mac).

   Selected plots such as scatterplots, scatterplot matrix, variable maps and line plots have a Copy Window button on their toolbar to copy the window at high resolution for large scale plotting, e.g. at A1 or A0 size.

Copy Plot as Image

1. Right-mouse click in an individual plot window and select from one of the following **Copy** options. The bitmap copy has a number of screen resolutions. The larger the resolution the larger the resulting image which is created.



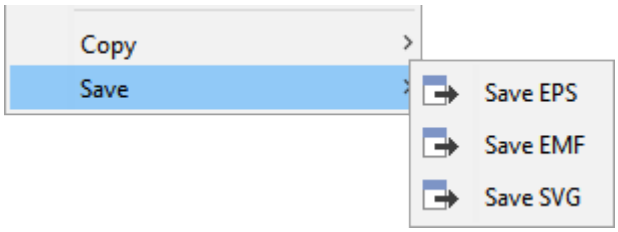
2. Paste into third party program such as Word, PowerPoint or image processing package using right-mouse click + **Paste** or Ctrl-V (Windows)/Command-V(Mac).

   It is also possible to copy windows in EMF (Enhanced Metafile format) and EPS (Encapsulated Post Script format). These are both vector based file formats that enable the image to be re-sized while retaining resolution and editing of the individual map components in other programs such as Corel Draw, Paint Shop, PowerPoint and Word.

Save Plot as Vector File

1. Right-mouse click in the graph window and select from one of the following **Save** options.
2. Enter a name and location for the saved file.

© Imdex Limited 2019



The EPS (Encapsulated Post Script), EMF (Enhanced Metafile) and SVG (Scalable Vector Graphics) are all vector based file formats that enable the image to be re-sized while retaining resolution and editing of the individual map components in other programs such as Corel Draw, Paint Shop, PowerPoint and Word.

Export Data

1. Go to the **File** ribbon to see options available in the Export band. Under **All** , choose **Export (All Rows)** or **Export (Visible Rows)**.

   ioGAS™ can export data in the following formats:

   - Excel Spreadsheet File
   - CSV Text File
   - Tab Separated Text File
   - Google Earth KMZ File (as Attribute Map)
   - AutoCad DXF File

   All Rows will export all the rows in the dataset whereas **Visible Rows** will only export data that is set as visible in the Attribute Manager. The Visible Row export option is good to use when you need to sub-set data into a separate file.

   The **Selected** option will export only the columns flagged as special in the **Column Properties** dialog plus the columns selected in the **Select Variables** dialog. Options to export all rows and visible rows are available from the drop-down menu.

Print

To print an individual graph directly from a plot window right-mouse click and select **Print** from the pop-up menu.

© Imdex Limited 2019

17. GIS Options

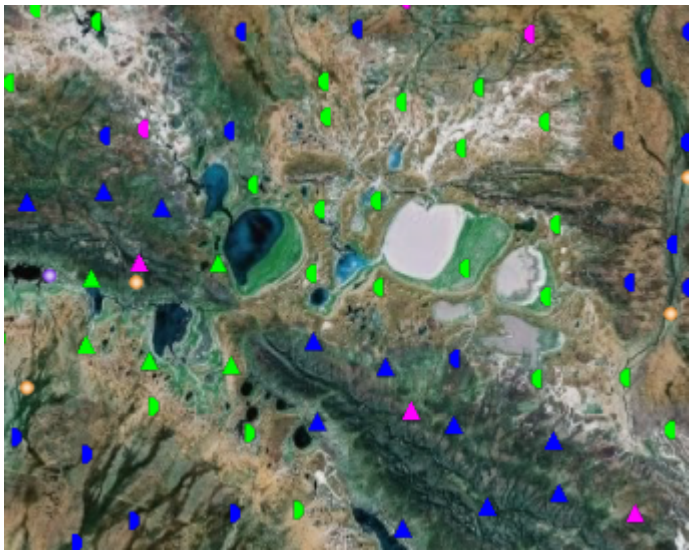
Google Earth

Attribute Maps and Variable Maps can be exported to Google Earth. When the Attribute Map is exported to Google Earth, the shape, colour and size attributes are rendered correctly. Variable Maps can also be exported into Google Earth, and like in ioGAS™ their colour and size are retained.

To export into Google Earth, the dataset must contain coordinates for each data point in Lat/Long WGS84 projection and these columns must be selected as the **WGS84 Longitude** and **WGS84 Latitude** columns in the **Column Properties** dialog (see Step 3). If the dataset only contains a projected coordinate system, it is possible to generate WGS84 coordinates using the **WGS84 Long/Lat** tool in ioGAS™.

1. To export to Google Earth use on the **Attribute Map** or **Variable Map** toolbars.

   Attribute maps can also be exported to Google Earth via **Google Earth** on the Attribute Map Export band on the **Map** ribbon or from the **All** or **Selected** options on the Export band of the **File** ribbon.



The colour, shape and size attributes are displayed in a pop-up window in Google Earth along with selected variable values and Sample ID. Other data may be displayed if it has been selected in the **Select Labels**.

ArcGIS Pro

Users of ESRI 64-bit ArcGIS Pro can import ioGAS™ attributed data using the ioGAS™ for ArcGIS Pro plugin available for download from our website.

See ioGAS™ for ArcGIS Pro for more information.

QGIS

Users of QGIS can import ioGAS™ attributed data using the ioGAS™ for QGIS plugin available for download from our website.

See ioGAS™ for QGIS for more information.

MapInfo

This option saves an Attribute Map or Variable Map including any colour, shape, size and visibility attributes and exports them to a MapInfo TAB file. The associated legend window is exported as a separate MapInfo TAB file as well. The **Export to MapInfo** utility is available in both the ioGAS™ 32 and 64-bit versions.

1. In the **Column Properties** dialog make sure that the **East/North Projection** is selected to match the coordinates in the selected **East** and **North** columns. If a non-earth projection is selected the data can still be opened in MapInfo but not overlain with other projected datasets.
2. To export to MapInfo use  on the **Attribute Map** or **Variable Map** toolbars.

   Attribute maps can also be exported to MapInfo via  **MapInfo** on the Attribute Map Export band on the **Map** ribbon
3. Assign a name and location for the MapInfo file and click **Export**.
4. Open MapInfo, browse to the Tab file and open.

The colour, shape and size attributes are exported along with selected variable values coordinate columns and Sample ID.

ioGAS™ attributed data can also be imported into MapInfo using the Datamine Discover Import Utility.

© Imdex Limited 2019

Datamine Discover Import Utility

© Imdex Limited 2019

18. Additional XY Scatter Plot Tools

Now that you are familiar with opening up data into ioGAS™ and doing some of the basic workflows here are some additional tools available from the XY and diagram toolbars to investigate further:

Mineral and rock nodes

Individual or groups of minerals or rocks can be plotted as nodes using the following toolbar buttons:

	**Show mineral and rock nodes** - Cycle through available mineral or rock node displays or right-mouse click and choose mode - node, node lines, node names or node formulae.
	**Mineral and rock node settings** - Select the mineral or rock nodes to display.

In order to display mineral or rock nodes on a plot, the variables used as the plot or diagram axes must be "aliased" in the **Column Properties** dialog. Mineral nodes can be projected regardless of oxide/element/unit of the geochemical variables displayed as the plot axes, even if the plot has calculated axes (including PCA). The currently selected mineral and rock nodes can be displayed on multiple plots and the current selection saved between work sessions.

Use the settings dialog to select the mineral and rock nodes and the show mineral and rock nodes button to display the nodes.

Point density grids

A point density display is a grid of the density of the data points within a graph to make it easier to visually determine where most of the data is concentrated.

Use the settings dialog to set up the point density grid parameters and the point density opacity button to display the grid.

	**Point density opacity** - Cycle through available point density opacity settings or right mouse-click and choose mode.
	**Point density settings** - Modify Point Density Grid Settings.

© Imdex Limited 2019

Mean/median crosses

Display mean and median crosses for entire dataset or colour group on selected plots and diagrams.

	**Show means** - Cycle through displaying location of mean for entire dataset or visible groups using solid cross symbol or right-mouse click and choose mode.
	**Change mean crosshair size** - only active when mean crosses displayed on plots. Cycle through displaying mean crosshairs sized by 1 x standard deviation or 2 x standard deviations or right-mouse click and choose mode.
	**Show medians** - Cycle through displaying location of median for entire dataset or visible groups using dashed cross symbol or right-mouse click and choose mode.

Regression & Y = X lines

Two types of regression methods are available in ioGAS™: ordinary least squares (OLS) and reduced major axis (RMA). The OLS method can also be forced to display through the origin (RTO).

	**Show regression line** - Cycle through colour group and/or all data regression line display or right mouse-click and choose mode. Place the cursor over a regression line to view the m (gradient), c (intercept) and r^2 values in a tooltip.
	**Change regression type** - Cycle through least squares regression, regression through the origin (RTO) and reduced major axis (RMA) regression or right mouse-click and choose mode.
	**Show line y = x** - Toggle to display Y = X trend line in plot window for entire dataset.

Mahalanobis Contour Ellipses

Classical and robust M-Dist ellipses can be displayed quickly on XY and SPLOM (scatterplot matrix) plots by using two options on the XY toolbar. The parameters used to display the M-dist ellipses are the same as the default input parameters for the M-dist methods available via the Analysis menu:

- **Classical M-dist**
- **Robust M-dist (M-estimation)** - ellipses calculated using Medium outlier rejection algorithm
- **Robust M-dist (Fast MCD)**

The ellipses may be displayed for all data, each colour group or both with four chi-squared cut-off values: p = 0.5, 0.95, 0.975 and 0.99 available.

	**Show Mahalanobis contour ellipses** - Cycle through p = 0.5, 0.95, 0.975 and 0.99 Mahalanobis ellipses or right mouse-click and choose mode.
	**Show robust Mahalanobis contour ellipses** - Cycle through p = 0.5, 0.95, 0.975 and 0.99 Robust Mahalanobis ellipses or right mouse-click and choose mode: The ellipses are calculated using the M-Estimation or Fast MCD robust algorithm. To set the algorithm to use see Calculate Mahalanobis Distance.
	**M-dist ellipse display mode** - Cycle through to show M-dist ellipses by colour group, by colour group + entire dataset and entire dataset or right mouse-click and choose mode.

19. Drillhole and Structural Data

ioGAS™ contains specialised tools for working with drillhole and structural data.

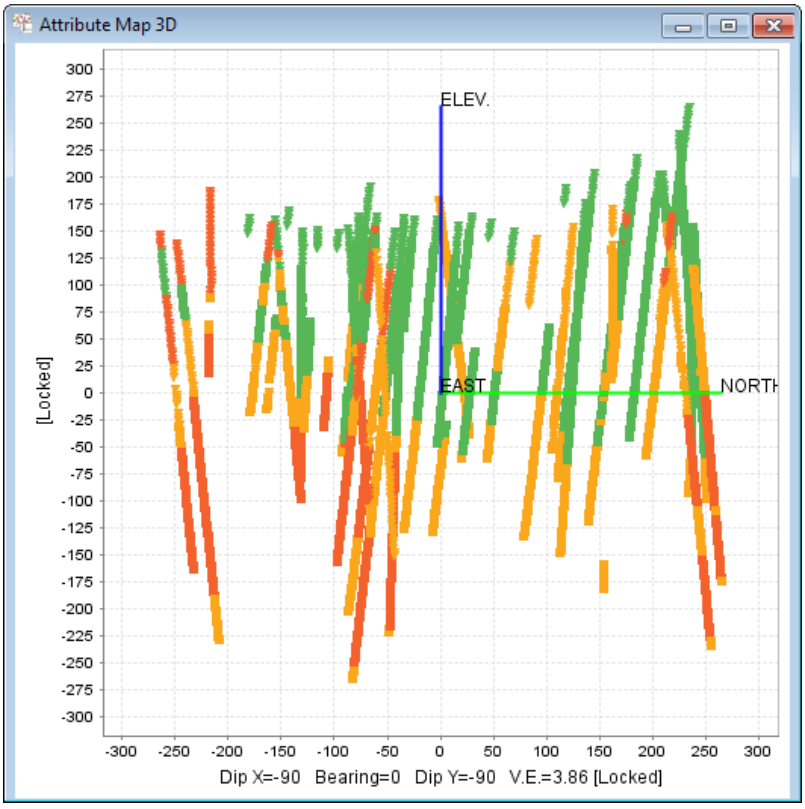
Drillhole Data

For examples of the following tools in action in ioGAS™ go to **Open>Open Demo Data** on any ribbon and select **Open Drillhole Demo Data**.

Attribute Map 3D

Select **Attribute Map 3D** on the **Home** or **Map** ribbon to display drillhole data using geographical XYZ coordinates in a 3D plot window. Individual data points can be attributed with up to three variables using colour/shape/size using the Attribute Manager and rotated to view their distribution within the dataset. Areas of interest can be isolated using visibility or filter controls. The 3D Attribute Map window updates dynamically like any other ioGAS™ plot window and data can be selected and attributed for closer analysis.

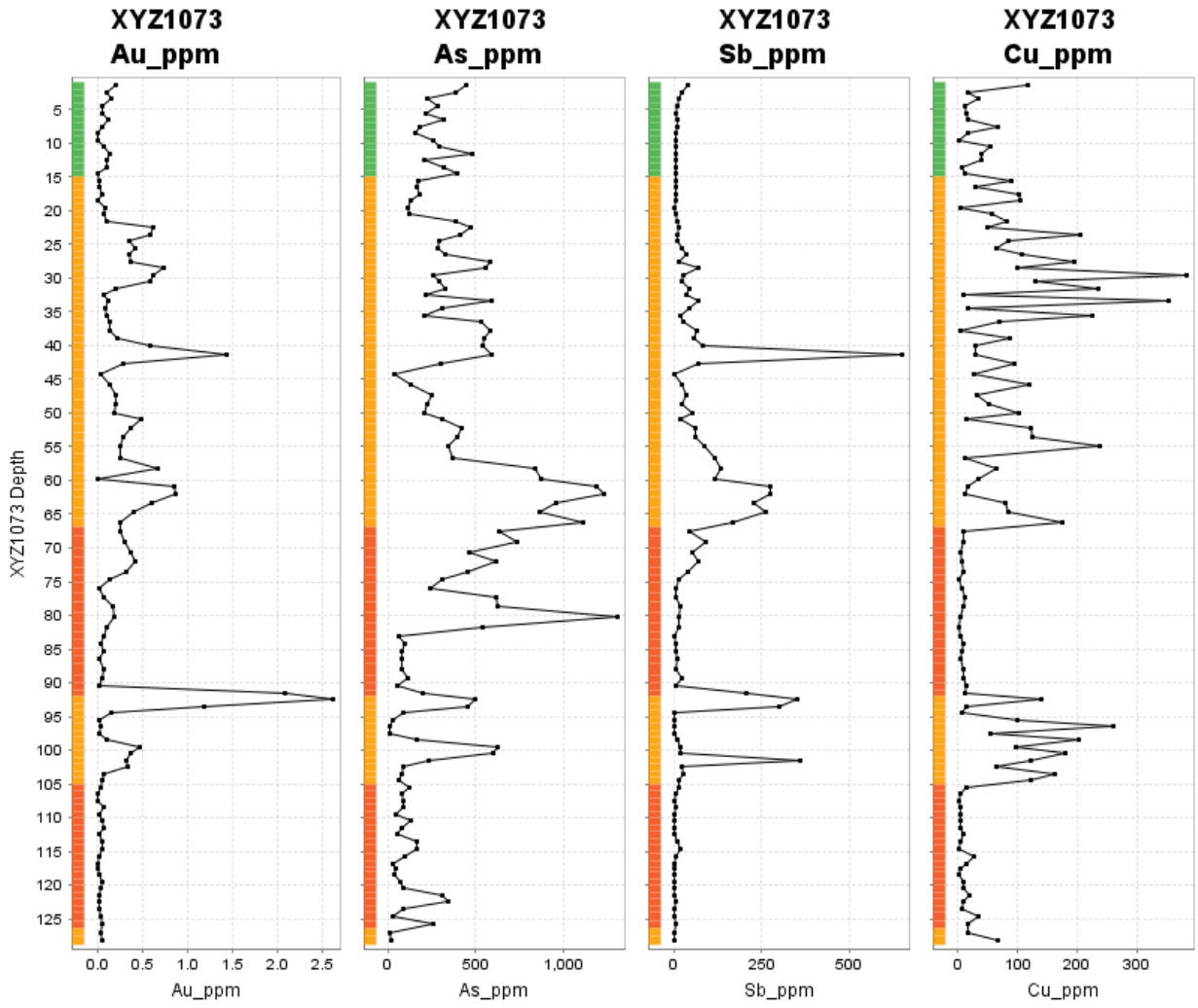
The dataset must contain east (X), north (Y) and elevation (Z) data columns which are mapped to East, North and Elevation in the **Column Properties** dialog.



Downhole Plots

Select **Downhole** on the **Home** or **Graph** ribbon to generate a downhole plot, or visual representation of drill hole data plotted on a vertical axis. Create individual plots using Hole ID and depth from/to or RL/elevation data.

Three downhole plot types are available. The multi-trace downhole plot can display up to 8 selected variable traces for one drillhole along its axis. Alternatively, each selected variable or group can be displayed in a single downhole plot. The distance along the axis of the downhole plot represents the distance in specified interval units. The traces on the plot are visual representation of numeric values of the selected variables.



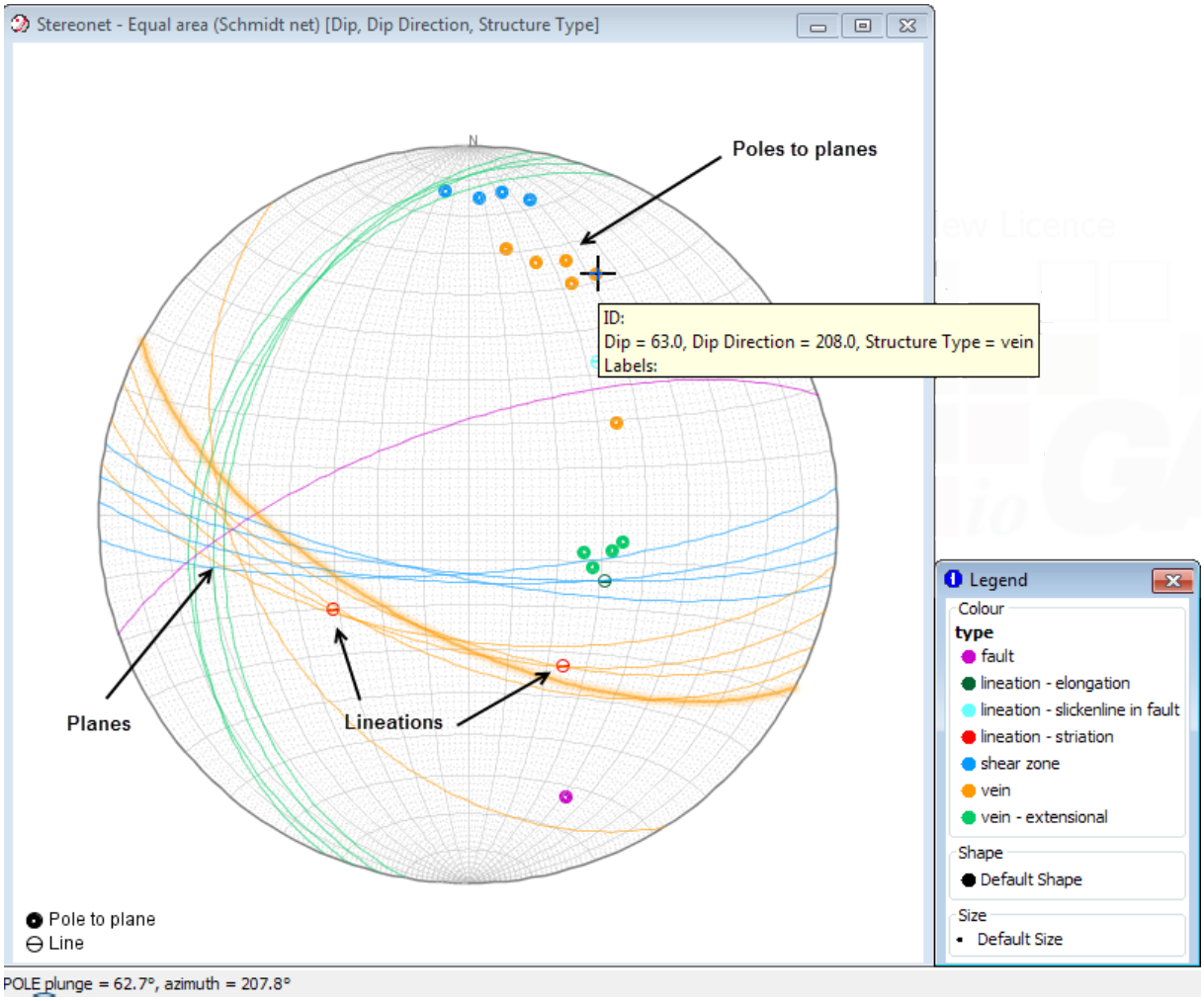
Downhole plot axes can be logged, zoomed and show common or individual axis scaling. Data points can display the current colour, shape, size and visibility and can be selected and attributed in the same way as in other plot windows. The colour bar alongside each downhole plot represents the current colour groups as set in the Attribute Manager.

© Imdex Limited 2019

Structural Data

For examples of the structural tools in action in ioGAS™ go to **Open>Open Demo Data** on any ribbon and select **Open Stereonet Demo Data**.

Select **Stereonet** on the **Structure** ribbon to generate a stereonet using Dip and Azimuth (Dip Direction) measurements. A Stereonet is a graphical representation of 3D structural data on a 2D surface and is used to analyse the angular relationships between lines and planes in 3D space. The stereonet plotting functionality in ioGAS™ includes the ability to plot lineations and planes, determine means per colour group, calculate beta axes, change plot projection on-the-fly and produce in-built calculated statistical reports.



Other structural tools available include alpha/beta/gamma structural data conversion and rose plots.

© Imdex Limited 2019

© Imdex Limited 2019

20. Multivariate Analysis Tools

Many of the analysis tools within ioGAS™ are located on the **Analysis** ribbon and are grouped into the following bands:

- Statistics
- Transformation
- Outlier Analysis
- Classify

We visited some of the more simple statistical tools during this tutorial however some of the more advanced tools require a deeper understanding of the underlying theory behind multivariate analysis before they should be used. A summary of the available analysis tools is provided below:

Statistics Band

Summary Statistics

Generate summary statistics for all variable columns as designated in the Select Variables dialog. Summary Statistics include count null, count zero, maximum, minimum, range, mean, median, percentile values plus many others. Statistics selected for display is fully customisable. Under the **Summary Stats** drop-down menu is the following option:

Summary Statistics (Special Columns)

Generate summary statistics for all special columns as designated in the Column Properties dialog. Special columns include Sample ID and coordinate columns.

Frequency Table

Frequency table indicates how many samples fall into each individual category or numeric value within the selected variable columns. Under the **Frequency Table** drop-down menu is the following option:

Frequency Table (All Columns)

Display frequency tables for all of the columns in the dataset.

CrossTab

Create a CrossTab table to show the count, mean, median, standard deviation, coefficient offset, minimum and maximum values for the selected numeric variables based on two categorising variables.

Correlation Matrix

Display the correlation coefficient for each pair of selected variables. Results can be calculated using classic Pearson or Spearman Ranked methods.

Regression

Regression analysis is used to determine the linear equation(s) that model the relationship between response and explanatory variables. Simple and multiple regression analysis are both available as well as a robust option to down-weight outlying data points.

Transform Band

Centred Log Ratio

Centred Log Ratio (CLR) transformation is used for "opening" constant sum data. Geochemical data sum to a constant (100% of mass) producing closure effects in data that may lead to induced correlations. The CLR transformation ‘opens’ the data and can be helpful for removing spurious correlations. This is especially the case with major element data.

Make Levelled Columns

Apply levelling operations (mean, median, Z-Score, etc) on selected data columns to distinguish anomalous values within datasets that contain multiple populations, e.g. different rock types, regolith units, mesh sizes, laboratory analysis methods, etc.

Weighted Sums

Weighted Sums is a simple multivariate technique used to reduce several variables to one variable where there is prior knowledge about the underlying processes. Each variable is assigned an importance value which is then normalised to make 'weights' so that the sums of the squares of the applied weights is 1.

© Imdex Limited 2019

Outlier Analysis Band

Auto-Attribute Tukey Outliers

Run a Tukey box plot algorithm and assign size and shape attributes to outlier samples that plot outside the main Tukey plot fence so they can be identified in other plots. Under the **Tukey Outliers** drop-down menu is the following option:

Auto-Attribute Tukey Outliers (Logged)

Run a Tukey box plot algorithm on log-transformed data and assign size and shape attributes to outlier samples that plot outside the main Tukey plot fence as they can be identified in other plots.

M-Dist (Compute Mahalanobis Distances)

Mahalanobis Distance (M-dist) is a multivariate analysis technique based on the means and variances of selected variables and on the covariances between each pair of variables. It is used to determine how far a sample value "lies" from the central tendency of a data group. Two robust M-dist algorithms are available in which "outlier" samples have reduced impact on the overall Mahalanobis distance calculations by assigning them less weighting. Under the **M-Dist** drop-down menu are the following options:

Classical

Standard M-dist calculation devised by P.C. Mahalanobis.

Robust (M-Estimation)

Robust variation of M-dist calculation based on the algorithm devised by N.A. Campbell.

Robust (Fast MCD)

Robust variation of M-dist calculation based on the algorithm devised by P.J. Rousseeuw and K. Van Driessen.

Distance-Distance Plot

Scatter plot of classical M-dist values vs robust Fast MCD M-dist values.

© Imdex Limited 2019

Set Robust M-Dist Algorithm

Choose robust algorithm to use in the Anomaly Assessment Tool and when displaying robust M-dist ellipses on scatter plots.

Anomaly Assessment Tool

Identify outliers or atypical samples within domain classified data using a combination of univariate test (Tukey plots) to isolate near and/or far outlier samples and multivariate test (robust variant of Mahalanobis Distance) to examine variable correlations within each domain.

Classify Band

RGB Zonation

Select three variables and set absolute value or percentile thresholds and then apply a colour RGB thematic to the data points according to how its values compare to the threshold value. For example, all samples which have values greater than the 80th percentile for the selected variables Cu, Au and Mo are coloured grey, whereas a sample which only has a Cu value greater than the 80th percentile is coloured blue.

DPA (Discriminant Projection Analysis)

Discriminant Projection Analysis (DPA) emphasises the projection component of discriminant analysis to produce visual outputs for exploratory data analysis. Samples are projected into a lower dimensional space to best show the separation between groups graphically. There are two steps involved in DPA: the 'projection step' and if required, the 'classification step'. DPA may also be used as an exploratory technique to indicate which of the selected variables are most important for determining maximum group separation. Under the **DPA** drop-down menu is the following option:

Variance Importance Plot

Find the subsets of input variables that best discriminate colour groups under DPA.

Auto-Domain

Automatically create a classification diagram from data groups. These groups could be *a priori* knowledge or generated from the K-means clustering or Discriminant Projection Analysis tools. Group boundaries are created using Mahalanobis Distance calculations.

© Imdex Limited 2019

PCA (Principal Component Analysis)

Principal Component Analysis (PCA) is a multivariate statistical technique used to reduce the dimensionality of data so as to maximise the variance. PCA finds the best set of linear equations to use to reduce the number of variables that are needed to describe a dataset. Reducing multivariate data to 2 or 3 derived variables enables it to be more readily visualised. Under the **PCA** drop-down menu are the following options:

Classical

Standard PCA calculation.

Robust (M-Estimation)

Robust variation of PCA calculation based on the algorithm devised by N.A. Campbell.

Robust (Fast MCD)

Robust variation of M-dist calculation based on the algorithm devised by P.J. Rousseeuw and K. Van Driessen.

Biplot

Two dimensional plot showing combinations of principal components 1 to 4 and original variables as vectors.

3D Biplot

Three dimensional plot showing principal components 1 to 3 and original variables as vectors.

SOM

Self-organising map (SOM) is an unsupervised training algorithm using neural networks to produce rapid classification of groups within a dataset. Under the **SOM** drop-down menu are the following options:

Create New SOM

Generate a new self organising map.

User

Library of user created SOMs.

© Imdex Limited 2019

Open Other SOM

Browse to the location of the SOM *.XML file to open.

Recent

List of recently opened SOMs.

Clustering

Apache K-means unsupervised clustering algorithm to partition a population of data into smaller sub-populations. Use to interrogate the grouping structure between variables and to prepare the dataset for further interpretation.

Wavelet Tessellation

Wavelet Tessellation is two analytical approaches to processing complex signals integrated together into one workflow. A wavelet transform is a process of performing multi-scale edge detection on a signal such as gamma or geochemical variable, while the wavelet tessellation turns the signal into an interpretable pattern that can be related to the geology.

Support

New single seat (perpetual) licences include 12 months technical support but ongoing maintenance must be purchased after this time in order to continue to receive technical support. Server and single seat (12 month) licences automatically include technical support in the purchase price.

Maintained clients can lodge support issues through the IMDEX Customer Care Portal. The portal can also be used to track and manage support queries, request enhancements and access knowledge base articles.

> You will need to register in order to use the Customer Care Portal.

Alternatively, contact us via email at iogas.support@imdexlimited.com.

© Imdex Limited 2019

Where possible include a screen capture of the **Help>About** information and a copy of the **log.txt** files located in the **C:\Users\ *Username* \AppData\Roaming\ ioGAS™ \log folder** (Windows) or the **Applications\ ioGAS™ \Contents\Resources\app\log** folder (Mac). Note Username = your login name.

The log files can also be accessed using the **Browse to Logs** button on the **Help** ribbon.

© Imdex Limited 2019