



GeoMate

2026 · Exploration Data Platform

ANALYSIS

MODULE 07

Geochemical Analytics

A consulting-grade exploration geochemistry workbench:
nineteen analytical tabs, lithogeochemical classification, and a
bilingual PowerPoint report engine.

- Group: Analysis
- Chart · statistics · GIS · PowerPoint export
- 19 analytical tabs
- 54 elements auto-detected



Executive summary

Geochemical Analytics is a complete exploration-geochemistry workbench: nineteen tabs running from univariate statistics to pathfinder vectoring, plus a bilingual PowerPoint report engine that renders the figures and the interpretation.

01 What it replaces

The descriptive-statistics spreadsheet, hand-redrawn charts and an anomaly threshold picked by eye off a histogram.

02 How it works

You pick the source and the elements, handle the below-detection values, apply the log transform where it belongs — then move through the tabs, from background to vectoring.

03 Who it is for

The exploration geologist who has to justify a threshold, and the consultant who has to deliver publication-grade figures without a second package.

19

analytical tabs

11 726

Au values in the real dataset

0,02 g/t

median of the geochemical background

0,64 g/t

98th percentile — anomaly threshold

Statistics computed on the Au assays of the KOUKOU DAN database.

Contents

01 What the module does

Turn an assay table into publication-grade multi-element geochemistry.

02 Data preparation

Below-detection handling, transforms, major oxides, computed columns.

03 Four analytical themes

Distribution, relationships, spatial, vectoring.

04 Population separation

Sinclair log-probability to set a defensible threshold.

05 Lithogeochemistry

TAS, Winchester & Floyd, AFM, Jensen, alteration indices, KNN classifier.

06 Outputs

Charts, statistics, GIS layers and a bilingual PowerPoint report.

07 Anonymised data

11,740 Au assays, from 0.005 to 55.9 ppm, P98 threshold at 0.64 ppm.

08 Business value

The geochemical report stops being outsourced.



GeoMate 2026

SECTION I

The module

The problem addressed, the capabilities delivered, the processing chain and the module's place in the platform.

-
- 01 Context
 - 02 Key capabilities
 - 03 Processing chain
 - 04 Place in the platform
-

Context

A modern multi-element certificate reports fifty to seventy variables per sample. The question is no longer “what is the gold grade”, but “which element associations describe a system, and where”.

The module reads the assay table, detects the element columns on its own, and opens nineteen tabs that run from univariate statistics to vectoring towards mineralisation.

Detection is automatic

On the demonstration set, 54 element columns are recognised out of 66: SiO₂, TiO₂, Al₂O₃, then Ba, Rb, Sr, Zr, Y, Nb, U, Th and the rare earths.

Below-detection values are handled

Half detection limit, substitution or exclusion — the choice is explicit and documented in the report produced.

The anomaly threshold becomes defensible

The log-probability plot separates background from the anomalous population; the threshold is read off the inflexion, not off a hunch.

Geochemical & Multi-Element Analytics

Distribution · relationships · spatial · vectoring

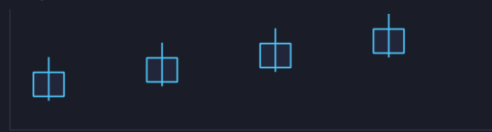
Histogram



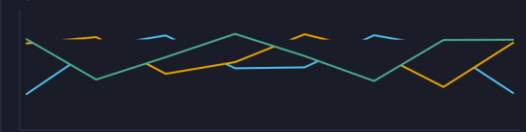
Scatter / cross-plot



Box plot



Spider (REE)



On altered rocks prefer the immobile-element diagrams (Winchester & Floyd, Zr/Ti against Nb/Y): major-oxide diagrams assume a chemically closed system.

Key capabilities



01

Distribution

Descriptive statistics, histograms, box plots, cumulative frequency, Sinclair log-probability for population separation.



02

Relationships

Pearson or Spearman correlation matrix, cross-plots with regression and confidence interval, pathfinder ratios, multi-element spider.



03

Spatial

Bubble maps, gridded surfaces, anomaly thresholds — with map-layer export.



04

Vectoring

Element associations, index calculations, zonation and vectoring towards mineralisation.



05

Lithogeochemistry

TAS, Winchester & Floyd, AFM, Jensen cation plot; Ishikawa and CCPI indices; multi-element fingerprint and KNN classifier.



06

Bilingual report

A built-in PowerPoint engine produces the geochemical report in French and in English, figures and interpretation included.

Processing chain

From the assay table to a defensible threshold and a publishable figure.

A Inputs

Multi-element assay table

- Element columns and their units
- Below-detection values to handle
- Coordinates for the spatial views
- Lithology and domain, for population comparison
- Analysis suite and method, for series consistency

B Analysis

Four families of tabs

- Distribution: statistics, histograms, box plots, cumulatives
- Log-probability: background / anomaly separation
- Relationships: correlation matrix, cross-plots, pathfinder ratios
- Spatial: bubble maps, interpolated surfaces, anomaly thresholds
- Vectoring: associations, indices, zonation towards mineralisation

C Outputs

Figures and report

- Anomaly thresholds justified by the population break
- Publication-quality exportable figures
- Bilingual FR / EN PowerPoint report
- Ranked targets for the next campaign
- Statistics tables reusable in the report

WHY LOG-PROBABILITY

A geochemical distribution is nearly always a mixture: a lognormal background and one or more anomalous populations. On a log-probability plot each population is a straight line, and the inflection gives the threshold — defensible because it is read, not chosen.

Place in the platform

FED BY

10 Assay Importer

Supplies the loaded multi-element certificates, column by column.

06 QAQC Manager

Guarantees the interpreted grades come from accepted batches.

03 Data Entry

Supplies the lithology and domain that give the populations their meaning.



Geochemical Analytics

The interpretation layer: it turns a column of grades into background, anomaly and a vector towards mineralisation.

FEEDS

17 Geological Intelligence

The thresholds and domains established here frame the estimation.

14 Report Builder

The figures and tables go straight into the exploration report.

11 Assay Intercept

The cut-off adopted here is the one to apply to the intercepts.



GeoMate 2026

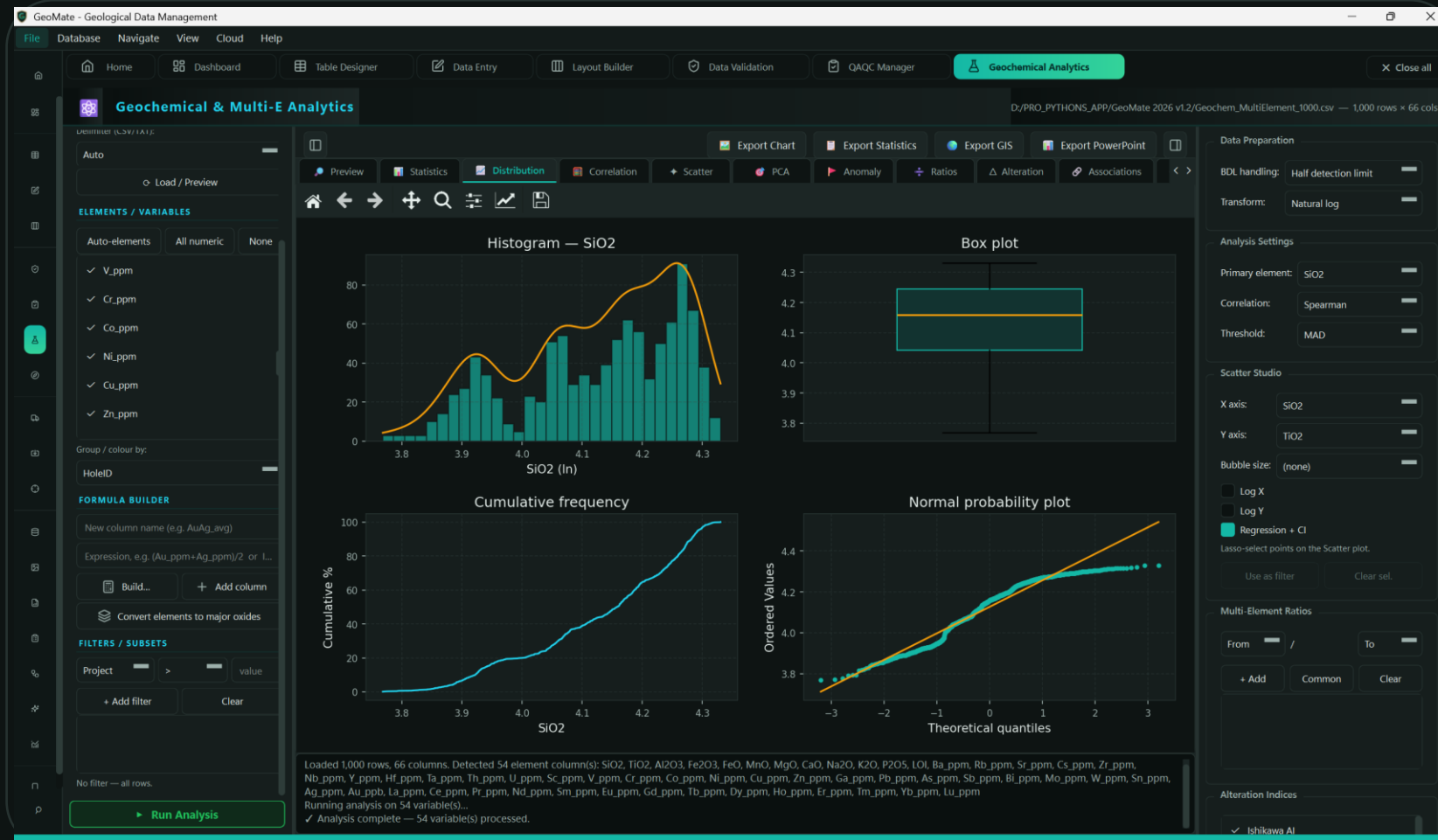
SECTION II

In practice

The real interface, the operating workflow, the reference settings, good practice and the questions that come up.

-
- 01 The interface
 - 02 Operating workflow
 - 03 In depth
 - 04 Good practice
 - 05 Frequently asked
-

The interface



1 Variable selection

Auto-elements, all numeric or manual pick; grouping and colouring by HoleID, lithology or domain.

2 Formula builder

Create a computed column — AuAg average, pathfinder ratio — and convert elements to major oxides.

3 Nineteen tabs

Preview, statistics, distribution, correlation, scatter, PCA, anomaly, ratios, alteration, associations.

4 Data preparation

Below-detection handling, log transform, Spearman correlation, MAD threshold.

5 Four exports

Chart, statistics, GIS layer and PowerPoint deck — from the same toolbar.

Actual GeoMate 2026 v2026.3.1.5 screen capture — Midnight theme.

Operating workflow

Five steps from the assay table to the bilingual report.

1

Pick the source

Database table or CSV; the element columns are detected automatically.

2

Clean and transform

Handle below-detection values, apply the log where the distribution warrants it.

3

Explore

Move through the tabs to characterise populations, correlations and spatial signature.

4

Set the threshold

Log-probability separates background from anomaly; the retained threshold stands up to an auditor.

5

Report

Generate the bilingual PowerPoint with the figures and the interpretation.

The four themes and their tabs

THEME	TABS	QUESTION IT ANSWERS
Distribution	Descriptive statistics · histograms · box plots · cumulative · log-probability	How many populations, and where the threshold falls
Relationships	Correlation matrix · cross-plots · pathfinder ratios · spider	Which elements travel together
Spatial	Bubble maps · gridded surfaces · anomaly thresholds	Where the anomaly sits on the ground
Vectoring	Element associations · index calculations · zonation	Which way is the core of the system
Lithogeochemistry	TAS · Winchester & Floyd · AFM · Jensen · Ishikawa · CCPI · KNN	Which rock, and how intense the alteration

Classification diagrams and indices

DIAGRAM / INDEX	USE	ROBUSTNESS TO ALTERATION
TAS	Total alkalis against silica — volcanic and plutonic naming	Low — assumes a closed system
Winchester & Floyd	Immobile elements Zr/Ti against Nb/Y	High — recommended on altered rocks
AFM	Tholeiitic against calc-alkaline trend	Low
Jensen cation plot	Sub-alkaline volcanic classification	Medium
Ishikawa index (AI)	Intensity of sericitic-chloritic hydrothermal alteration	Designed for alteration
CCPI	Chlorite-carbonate-pyrite index, complementary to AI	Designed for alteration
KNN classifier	Assigns a rock class from labelled training samples	Depends on the training set

Good practice

What has to be done before publishing a geochemical threshold.

✓ Handle the below-detection values

Replacing them with half the detection limit is the usual convention; leaving them at zero distorts the lower tail and therefore the background.

✓ Work in log space

A grade distribution is lognormal: the raw arithmetic mean is dominated by a few values and describes nothing.

✓ Separate by domain

Mixing two lithologies produces a bimodal distribution that will be read as an anomaly. Compare the populations first.

✓ Read the threshold, do not pick it

The inflection on the log-probability plot is a measured fact; a round percentile is a convention. The first defends better.

✓ Check suite consistency

Two analytical methods share neither detection limit nor bias: mixing them creates an artefact at the join.

✓ Confirm the anomaly in space

A statistical population is only a target if it holds together in space. The bubble maps and surfaces check that.

Frequently asked

The most frequent questions of method.

Q Why do my statistics look wrong?

Almost always because below-detection values were left raw, or because two analysis suites are mixed in the same column.

Q Percentile versus log-probability — what is the difference?

The percentile is a convention applied to the distribution; log-probability reads a real break between populations in it. The second can be argued in front of a committee.

Q What are pathfinder ratios?

Ratios between elements associated with mineralisation — they often carry a signal further from the target than the economic element itself.

Q Correlation matrix on which transform?

On transformed values, not raw ones: otherwise the correlation mostly measures the effect of a handful of extremes.

Q Is the report genuinely bilingual?

Yes: the engine produces a PowerPoint deck in French or in English, figures and interpretation included.

Q How many values before it means anything?

There is no single threshold, but an anomalous population read off fewer than about thirty values needs spatial confirmation before being presented.



GeoMate 2026

SECTION III

The data

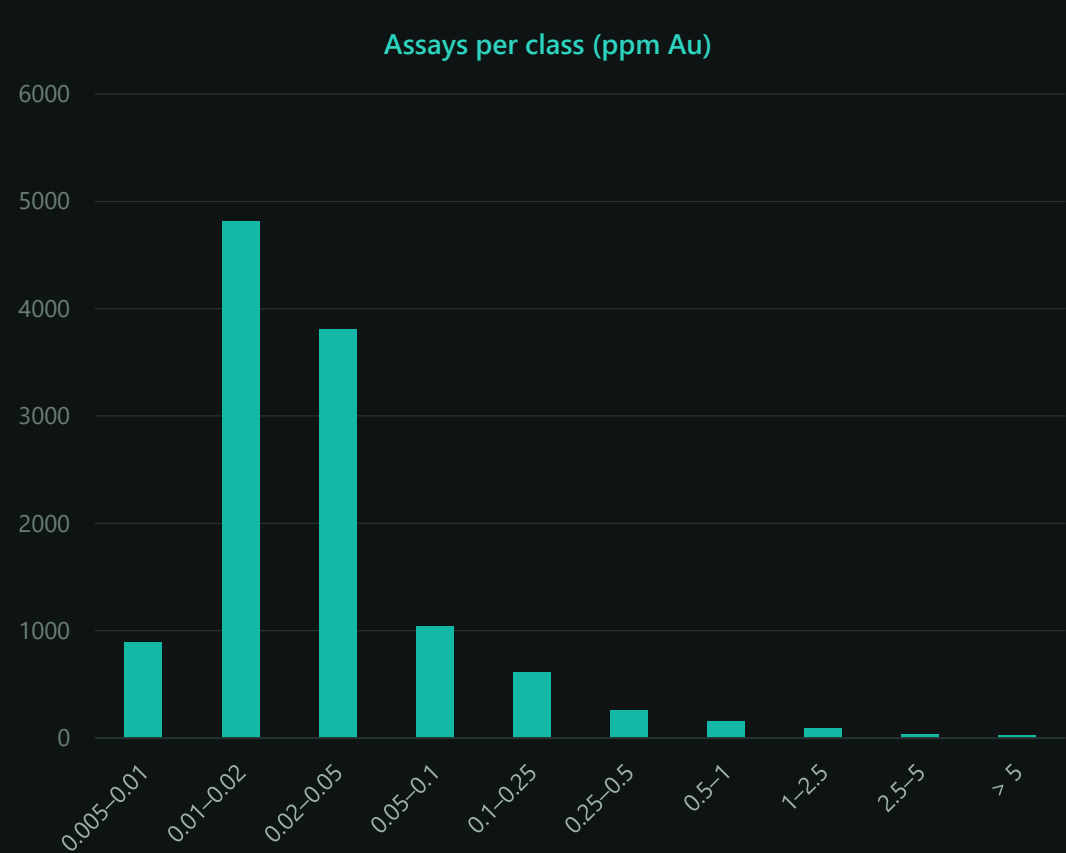
What the module produces on a real dataset, and the vocabulary needed to read those results.

01 Anonymised data

02 Key concepts

Anonymised data

Real distribution of the 11,726 Au values in the KOUKOUDAN database, by grade class.



STATISTIC	VALUE
Assays retained	11 726
Minimum	0.005 ppm
Median	0.02 ppm
Mean	0.0949 ppm
P90	0.09 ppm
P95	0.23 ppm
P98	0.64 ppm
P99	1.32 ppm
Maximum	55.9 ppm
Above 0.5 ppm	299
Above 1.0 ppm	147
Above 5.0 ppm	26

The break in slope between P95 and P98 is the one the log-probability plot uses to set the anomaly threshold. Source: KOUKOUDAN project database (Senegal) — figures computed from the real data exported from GeoMate.

Key concepts

The vocabulary of exploration geochemistry.

Geochemical background

The normal grade of the host rock, away from the influence of mineralisation. It is the reference against which an anomaly is defined.

Log-probability

A plot on which a lognormal population reads as a straight line. Its inflections reveal the mixture of several populations.

Vectoring

Using variations in associations and indices to indicate the direction of the mineralised centre from a peripheral anomaly.

Anomaly threshold

The value beyond which a grade stops belonging to the background. Read at the population break it defends; chosen round, it is arguable.

Pathfinder element

An element associated with mineralisation, often more mobile than it, whose anomaly extends further and is detected earlier.

Detection limit

The smallest grade the method can distinguish from zero. Below it, the reported value is a convention, not a measurement.



GeoMate 2026

SECTION IV

Value & specifications

What the module changes for the project, and its technical integration profile.

01 Business value

02 Technical profile

Business value

The anomaly threshold stops being arbitrary

An inflexion on the log-probability plot is an argument; “we took the 95th percentile” is not.

Defensible threshold

Fifty-four elements, not one

Automatic detection exploits the whole certificate instead of the gold column alone — pathfinders come for free.

54 variables

The report is produced, not outsourced

The bilingual PowerPoint engine delivers in-house what was usually bought from a consultant.

FR + EN

Lithogeochemistry is built in

Classification, alteration indices and multi-element fingerprint live in the same module as the statistics.

7 diagrams

Map output closes the loop

The identified anomaly leaves as a GIS layer, straight into planning the next drill programme.

GIS export

Technical profile

Inputs

Sources

Database table or CSV / TXT, auto delimiter

Detection

54 element columns out of 66 in the demonstration set

Below detection

Half limit, substitution or exclusion

Transforms

Natural log, log10, Z-score

Methods

Correlation

Pearson or Spearman

Threshold

MAD, percentile, or log-probability inflexion

Multivariate

PCA with biplot and loading vectors

Classification

TAS, Winchester & Floyd, AFM, Jensen, KNN

Outputs

Chart

High-resolution PNG, light or dark theme

Statistics

Tables exportable to Excel / CSV

GIS

Georeferenced point layer

Deck

Bilingual FR / EN PowerPoint



One platform, from field to report

The “Geochemical Analytics” module is one of the 19 modules of GeoMate 2026 — a single, fully offline platform covering the whole chain: database design, data entry, validation, QA/QC, dispatch, analysis and reporting.