VINCI TECHNOLOGIES
Laboratory and field instruments for Petroleum Industry

ISO 9001 BUREAU VERITAS Certification

GEOCHEMICAL CALCULATION SOFTWARE

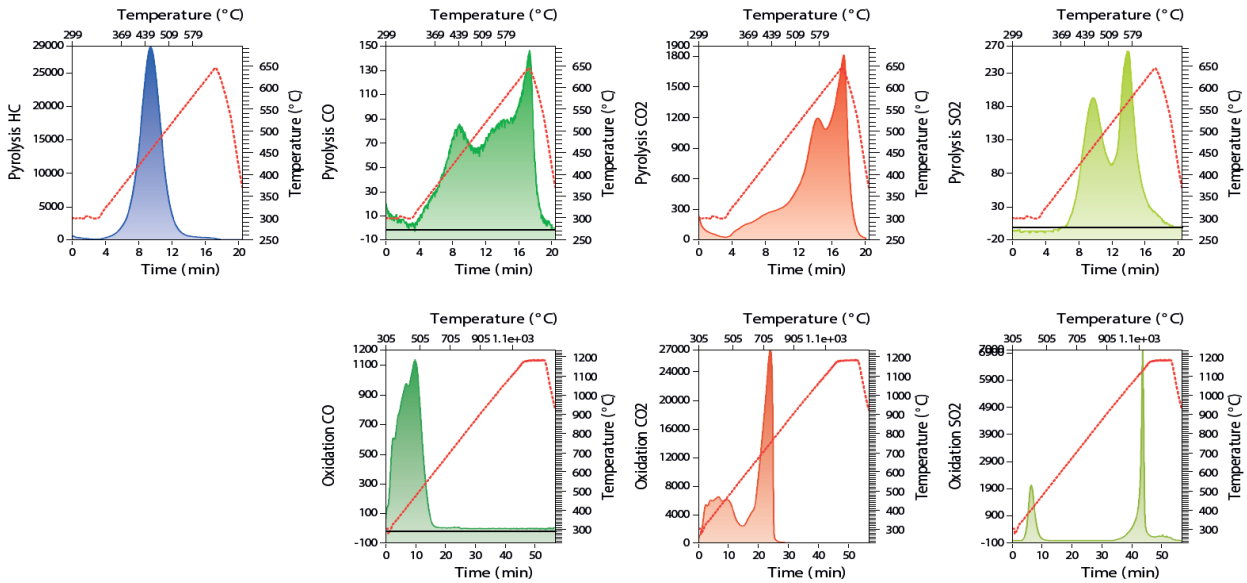
Geoworks™

Geoworks® stands as Vinci Technologies' most up-to-date suite for geochemical analysis. Primarily designed for raw data collection, visualization, and possible adjustments through interactive cursors and specialized modules, the software offers seven distinct analysis methods to accommodate various sample types: bulk rock, pure kerogen, reservoir, pure oil, coal, gas shale, and multi-heating rate. The core module of Geoworks incorporates all functionalities found in the Rock-Eval Reader, as detailed in the brochure.

The results and calculations generated by Geoworks® are immediately applicable for correlating data between wells and for comparative data analysis.

The software base can be extended with the following modules to enhance its functionalities:

- **Study module**
- **Simulated distillation module**
- **Quick-kinetics module**
- **Multi-kinetics module**
- **CleanSim module**
- **Quick modelling module**
- **HTML reports module**



➔ *Overview of GEOWORKS records from raw rock analysis.*

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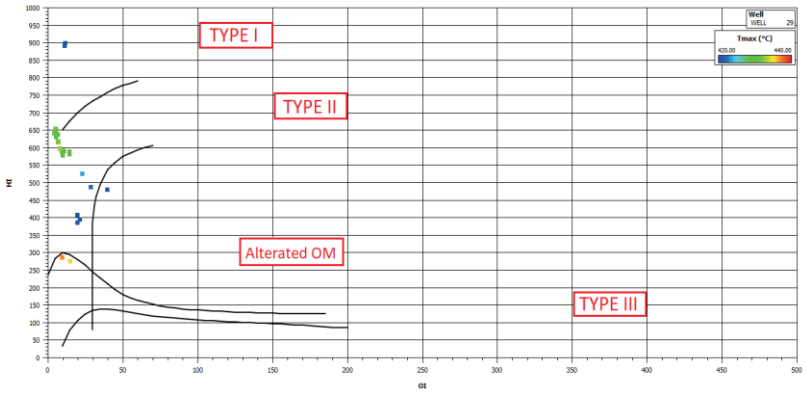
Key improvements that set Geoworks® apart from earlier software versions include a more flexible, user-friendly interface for file storage and management, 64-bit Windows OS compatibility, enhanced visualization features for sulfur dioxide parameters like pyrolysis and oxidation, automatic window resizing, advanced kinetics and quick modeling capabilities, online reporting, and real-time support from our expert engineers.

Geoworks® incorporates various analysis methods to cater to different sample types, featuring automated calculations that facilitate the determination of:

- Type, quality and quantity of kerogen,
- Quantities of light and heavy oil, as well as NSO compounds in reservoirs,
- Both organic and mineral sulfur levels
- Interpretation of shale gas, including total produced gas and oil quantities (both free and adsorbed),
- Kinetics and Modelling studies

STUDY MODULE

The Study Module offers advanced capabilities for more than just rudimentary data screening. It enables **complex data manipulation tasks**, such as the integration, removal, or modification of well data and associated parameters. Customization options for tabular data are also available. Additionally, the module supports advanced data visualization techniques, allowing users to employ either **standardized** formats like the Van Krevelen diagram or to generate bespoke **graphical representations** based on specific requirements.



➔ *Example of a Van Krevelen Diagram with a third parameter included: **Tmax**.*

The Study Module also encompasses the generation of **geochemical logs, litho-stratigraphic columns, and reports**, which are available in either metric or imperial measurement systems.

➔ *Example of a custom log made with Geoworks® study module.*

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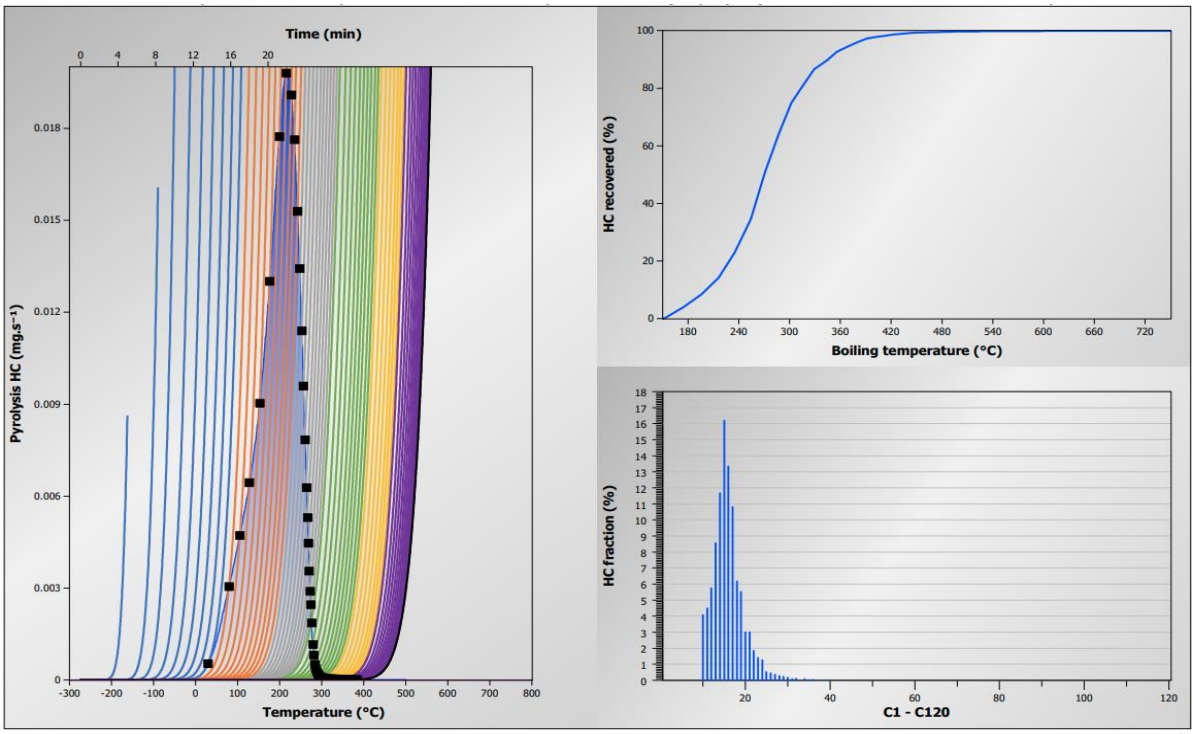
SIMULATED DISTILLATION MODULE

This feature enables the differentiation of various alkanes (ranging from **C1 to C120**) found in oil within a reservoir. It presents both the **distribution chart** and the **simulated distillation curve** specific to the oil sample under investigation.



➔ *Geoworks® "Simulated Distillation" module is used for rapid determination of an in-situ oil composition.*

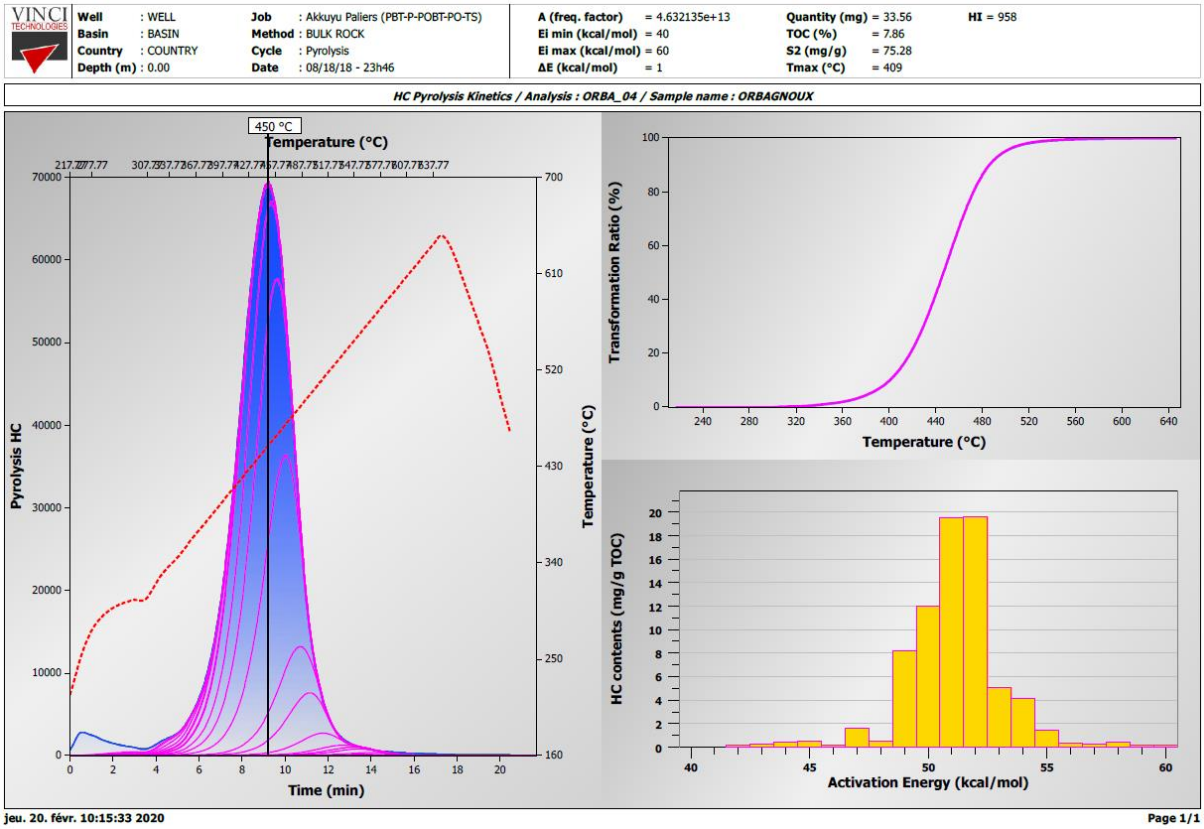
The calculations rely on **Antoine's equation curves**, which model the phase transitions of n-alkane hydrocarbons (from C1 to C120) at a single heating rate, measured in degrees Celsius per minute.

	n-Ci	Teb (°C)	Cumul. %	%	mg	Parameters
1	1	-162	0.00	0.00	0.000	**n-Ci min**
2	2	-89	0.00	0.00	0.000	1
3	3	-42	0.00	0.00	0.000	**n-Ci max**
4	4	-0.5	0.00	0.00	0.000	120
5	5	36	0.00	0.00	0.000	**Analyzer**
6	6	69	0.00	0.00	0.000	RE6
7	7	98	0.00	0.00	0.000	**Vol. flow (ml/min)**
8	8	126	0.00	0.00	0.000	100
9	9	151	0.01	0.01	0.000	**Gradient (°C/min)**
10	10	174	4.08	4.08	0.241	22.3047
11	11	196	8.59	4.51	0.267	**M (g/mol)**
12	12	216	14.34	5.75	0.340	226.035
13	13	235	22.92	8.58	0.507	**IBP (°C) - C9**
14	14	254	34.60	11.69	0.691	151
15	15	271	50.82	16.21	0.959	**FBP (°C) - C61**
16	16	287	64.17	13.35	0.790	623.9
17	17	302	74.99	10.82	0.640	
18	18	316	81.16	6.17	0.365	
19	19	329	86.69	5.53	0.327	
20	20	344	89.70	3.01	0.178	
21	21	356	92.72	3.02	0.179	
22	22	369	94.58	1.86	0.110	
23	23	380	96.00	1.42	0.084	
24	24	391	97.27	1.27	0.075	
25	25	402	97.80	0.53	0.031	
26	26	412	98.24	0.44	0.026	
27	27	422	98.60	0.36	0.021	
28	28	431	98.89	0.29	0.017	
29	29	440	99.13	0.24	0.014	
30	30	449	99.31	0.17	0.010	

This module also provides details about the oil's composition, including parameters such as **average molecular weight, initial boiling point** (IBP), and **final boiling point** (FBP).

QUICK-KINETICS MODULE

Utilizing the **Tissot-Espitalié model,** this module enables the rapid **determination of activation energies distribution for S2 and sulfur peaks**, which are obtained via pyrolysis conducted at a **single, controlled heating rate**, denominated in degrees Celsius per minute.



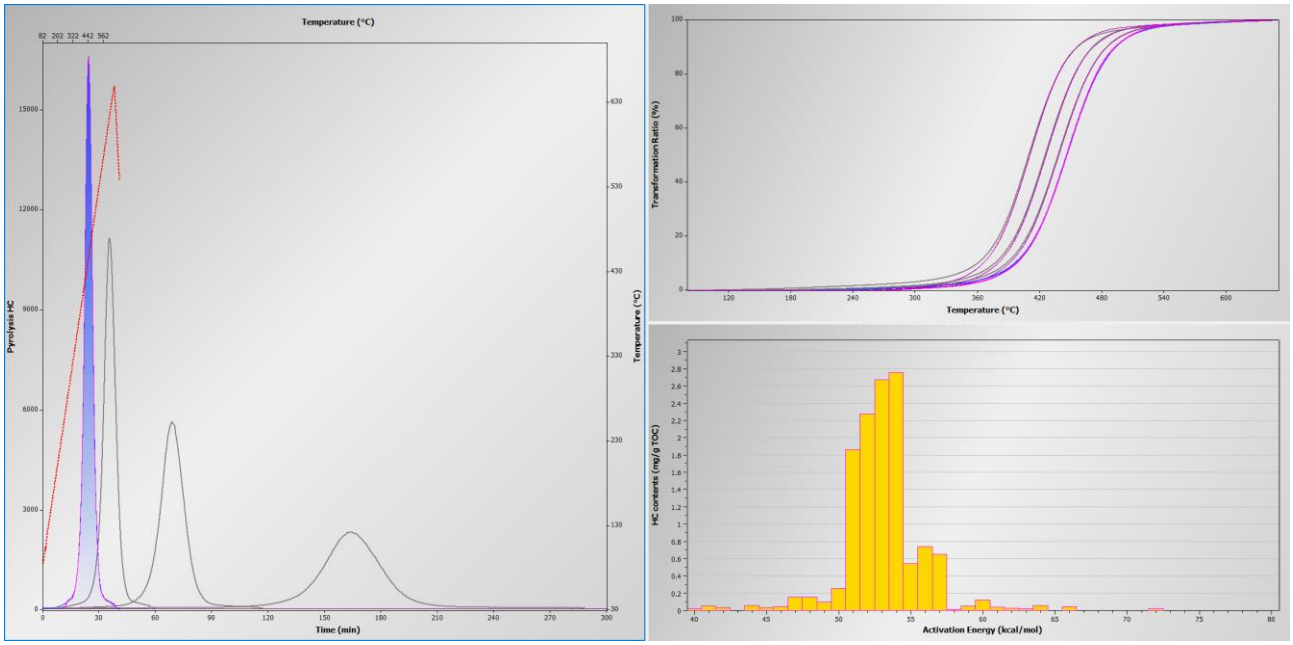
➔ *Geoworks® "Quick Kinetics" module used for rapid determination of activation energies distribution for S2 peak. (this screenshot also shows Geoworks® printing mode with its customizable print header)*

	Ei (kcal/mol)	%	mg/g TOC	Parameters
1	40	0.00		**Emin (kcal/...**
2	41	0.00		40
3	42	0.19	1.82	**Emax (kcal/...**
4	43	0.39	3.75	60
5	44	0.55	5.28	**DeltaE (kcal...**
6	45	0.70	6.70	1
7	46	0.25	2.44	**A**
8	47	2.10	20.07	4.632135e+13
9	48	0.72	6.88	**Residual Error**
10	49	10.94	104.81	2.499323e-07
11	50	15.96	152.85	**kS2 (mg/g)**
12	51	26.00	249.06	75.28
13	52	26.14	250.46	**kHI (mg/g T...**
14	53	6.80	65.17	958
15	54	5.56	53.27	
16	55	1.95	18.68	
17	56	0.46	4.39	
18	57	0.32	3.06	
19	58	0.56	5.34	
20	59	0.18	1.70	
21	60	0.23	2.25	

Users have the option to manually configure **a frequency factor (A) or allow the software to optimize it within a predefined range**. Additional computational settings enable more detailed and precise kinetic analyses. All numerical outcomes from these kinetic calculations are organized into specialized tables for easy access and interpretation.

MULTI KINETICS MODULE

This module offers functionalities akin to those in the Quick Kinetics module but distinguishes itself by allowing analyses of the **same sample at multiple or identical heating rates**. Given the varying opinions in scientific literature on the most appropriate kinetic approach, Geoworks® software provides both Quick and Multi Kinetics options. While the Quick Kinetics methodology offers expedited analyses, the Multi Kinetics approach may yield **more accurate results** but necessitates additional preliminary analyses.



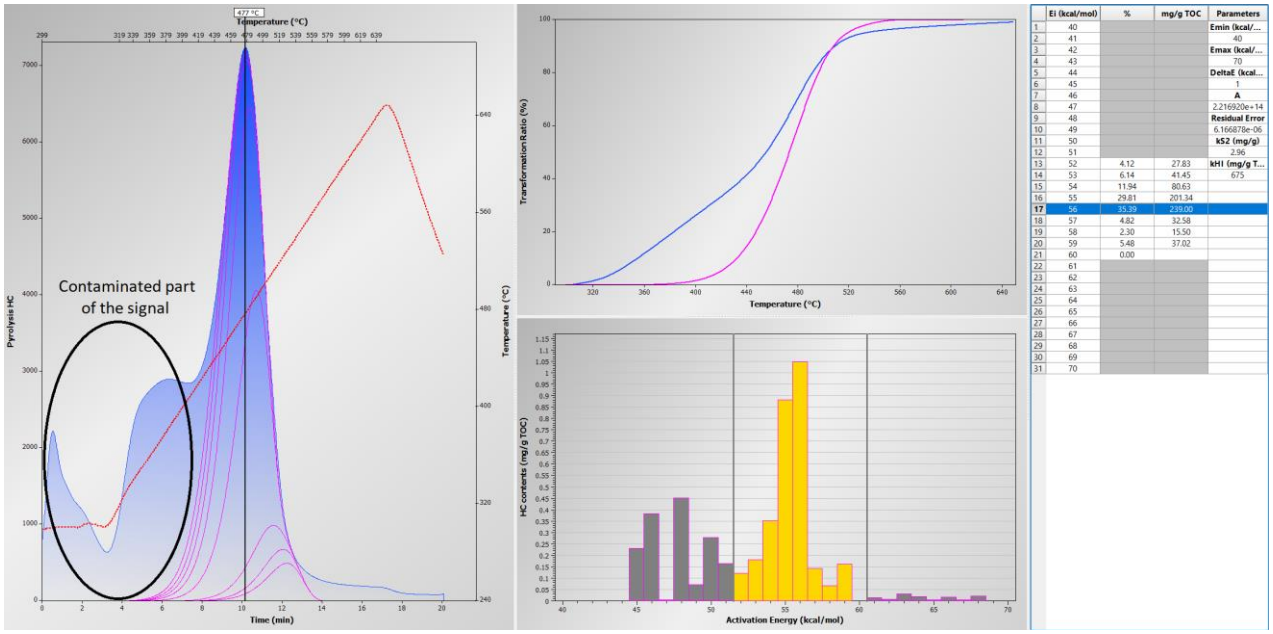
➔ *Geoworks® "Multi Kinetics" results for the same sample at different heating rates*

	Ei (kcal/mol)	%	mg/g TOC	Parameters
1	40	0.60	6.92	**Emin (kcal/...**
2	41	0.17	1.94	40
3	42	0.23	2.71	**Emax (kcal/...**
4	43	0.24	2.78	70
5	44	0.42	4.86	**DeltaE (kcal...**
6	45	1.09	12.68	1
7	46	0.66	7.65	**A**
8	47	0.00		3.611109e+13
9	48	2.92	33.88	**Residual Error**
10	49	4.67	54.20	1.564247e-06
11	50	15.80	183.25	**kS2 (mg/g)**
12	51	24.13	279.90	12.91
13	52	22.44	260.23	**kHI (mg/g T...**
14	53	5.41	62.80	1148
15	54	14.25	165.29	
16	55	0.59	6.79	
17	56	1.00	11.55	
18	57	2.43	28.24	
19	58	0.19	2.23	
20	59	0.26	2.99	
21	60	0.21	2.49	
22	61	0.52	6.07	
23	62	0.00		
24	63	0.37	4.23	
25	64	0.21	2.39	
26	65	0.00		
27	66	0.00		
28	67	0.00		
29	68	0.00		
30	69	0.00		
31	70	1.18	1.76	

All **recalculated parameters,** including kS2, kHI, kTOC, kTmax, and others, along with kinetic distributions, are compiled into comprehensive tables. These tables aggregate results from all examined samples to facilitate enhanced data extraction and sharing capabilities.

CLEAN-SIM MODULE

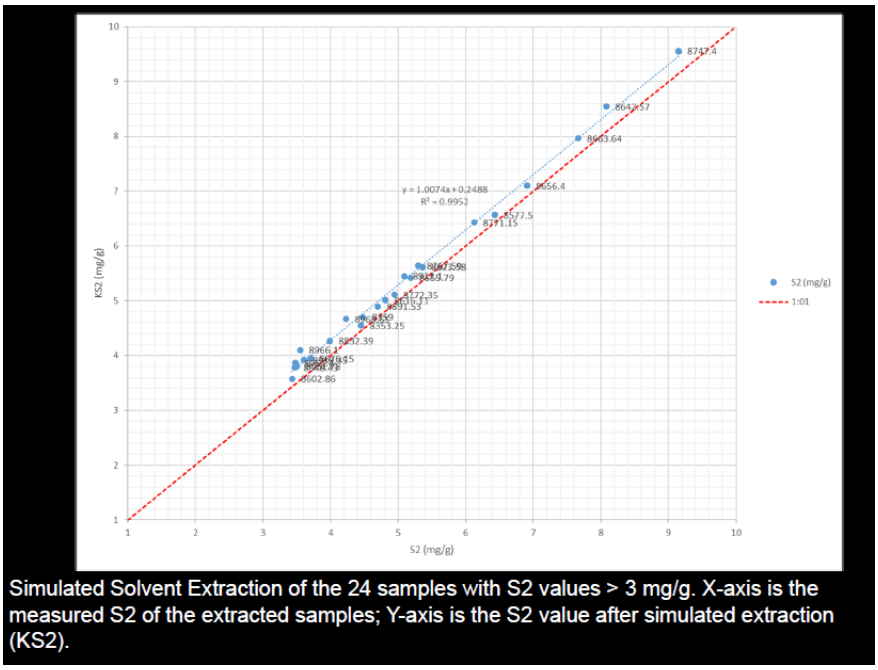
This module performs **solvent extraction simulations** using Rock Eval data from cuttings samples that may be contaminated with oil-based mud or other freely occurring hydrocarbons. **Through deconvolution techniques and cursor-guided kinetic parameters, a corrected S2 peak is generated**. The module enables rapid sample **purification without the need for prior manual intervention**.



➔ *Geoworks® CleanSIM module used to isolate S2 peak from drilling mud contamination.*

The juxtaposition of outcomes from traditional Soxhlet solvent extraction and simulated extraction via Geoworks® CleanSIM module is quite telling.

The correlation is exemplary, with an **R² value of 0.9952.**



Simulated Solvent Extraction of the 24 samples with S2 values > 3 mg/g. X-axis is the measured S2 of the extracted samples; Y-axis is the S2 value after simulated extraction (KS2).

➔ *Correlation between CleanSIM module and Soxhlet solvent extraction results on samples from the Permian Basin.*

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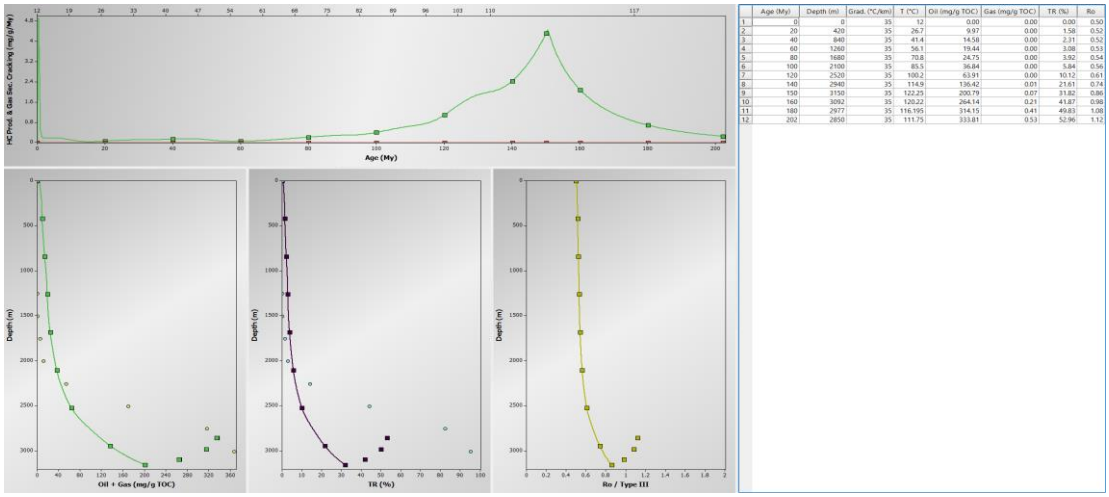
QUICK MODELLING MODULE

The Quick Modelling module serves as an **efficient instrument for fine-tuning kinetic parameters** derived from either **Quick or Multi-Heating Kinetics**. The approach involves employing both the kinetics and modelling modules in tandem to **accurately simulate the hydrocarbon yield of a source rock within a specific geological basin**. The simulated data is then compared against actual **field data to validate the reliability of the model and kinetic parameters**. Multiple sets of kinetic parameters should be evaluated to align the simulation as closely as possible with the real-world basin information.

When the basin's burial history is well-understood—capturing variables like formation depth, geological time scale, and geothermal gradient—the Quick Modelling module can not only calibrate the sample's kinetics but also estimate parameters like thermal maturity (Ro), simulated vitrinite reflectance (VRo%), transformation ratio (TR), and the volume of hydrocarbons generated.

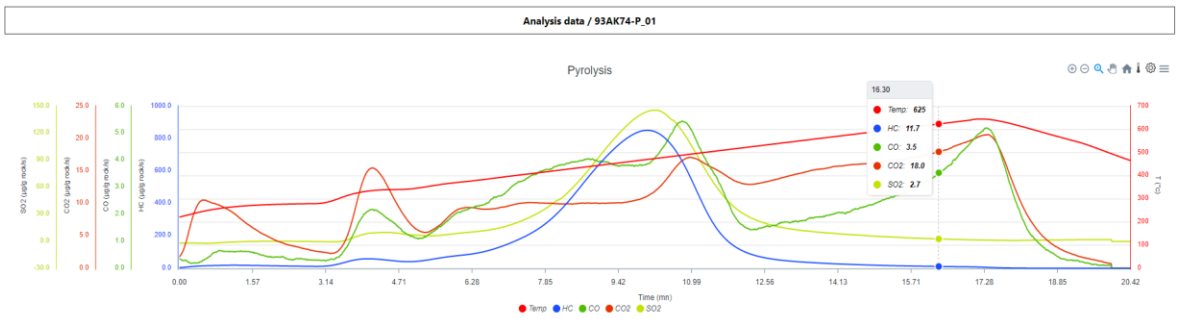
If the burial law of the targeted basin is not known, users can opt to employ a pre-configured sedimentary basin model, such as the Paris Basin provided by Vinci Technologies, or add another model with similar characteristics as a reference point for the module.



➔ *Geoworks® Quick Modelling module used on a source rock from the Toarcian layer of the eastern edge of the Paris basin.*

HTML REPORTS MODULE

The module offers the capability to export results in **.html** format, facilitating data sharing in a lightweight manner. It also provides swift access to review outcomes via predefined tables or interactive visualizations. The platform is optimized for **use on both smartphones and tablets.**



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