VINCI TECHNOLOGIES
Laboratory and field instruments for Petroleum Industry

ROCK-EVAL 7S

DEVICE :

Considered to be a pioneer in Petroleum Laboratory know-how, **Vinci Technologies** has been offering **Rock-Eval** devices since the 1970s (240+ units worldwide – **more than 40 years of experience**), committed to bring to market the **best engineering solutions and innovations** to **bolster major discoveries**.

The **Rock-Eval 7S** is the latest advanced **open environment thermal analysis instrument** developed in our laboratories. It takes over the function of its predecessor the Rock-Eval 6 with even **more advanced analysis techniques** and **new data acquisition methods**.

➔ *Rock-Eval 7S*

The presence of sulfur in oil reservoirs and / or oils plays an important role in issues related to oil exploration and refining. Rock-Eval 7S and Geoworks software make it **possible to analyze organic and mineral sulfur** in addition to hydrocarbons, CO and CO_2 and thus better understand the issues linked to oil exploration and exploitation.

Rock-Eval allows a million year long process of thermal cracking to be replicated and assessed in about one hour.

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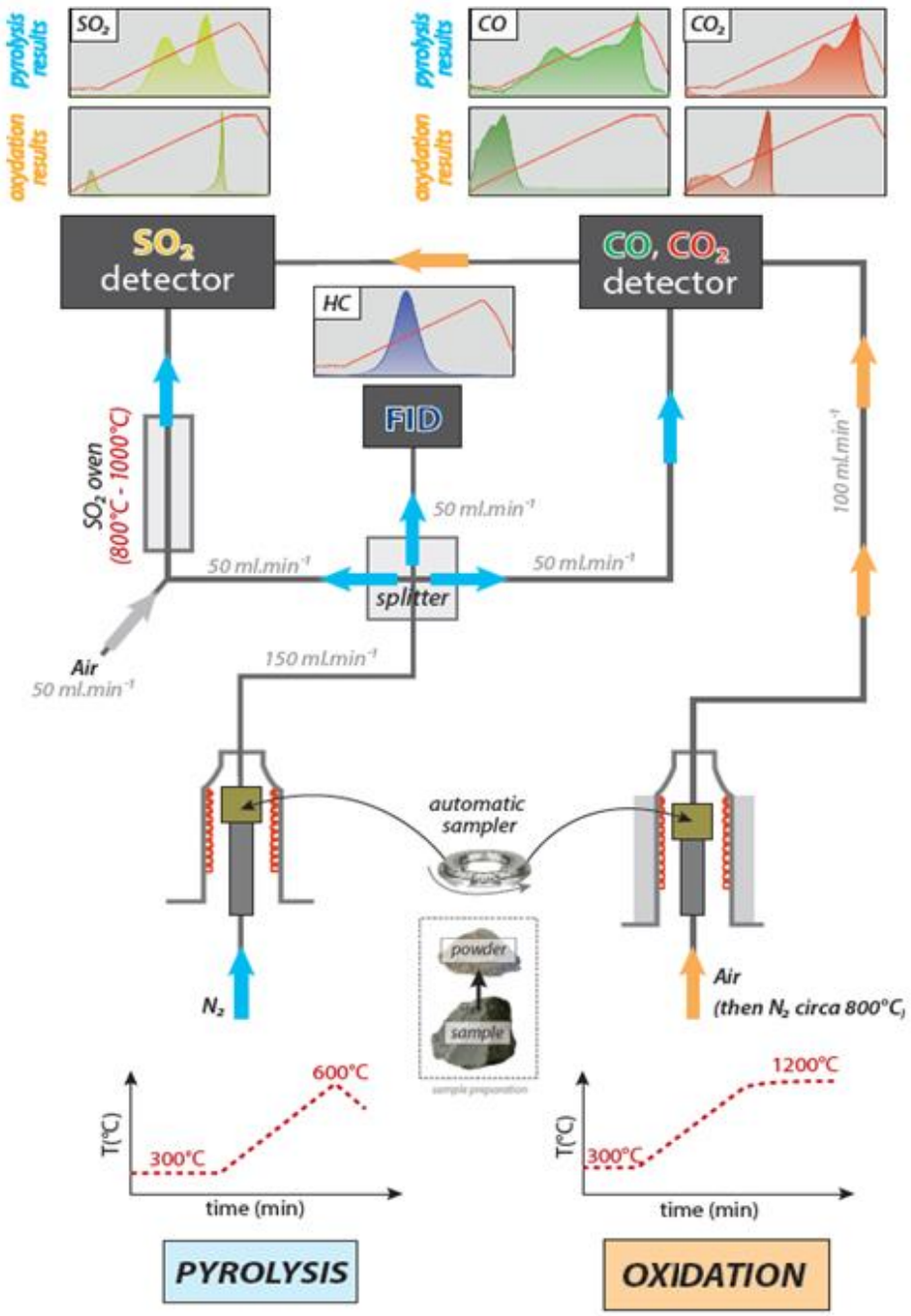
NEW FEATURES:

- **Sulfur containing products** formed during pyrolysis and oxydation phases are **continuously burned at 900°C** in a mini-oven under dry air atmosphere, **converted into SO2 and sent to an infrared detector**.
- Possibility to start **pyrolysis cycle** run at **20°C above ambient temperature**.
- More efficient **oxidation cycle** that **can reach the temperature of 1200°C** allowing decomposition of compounds with high thermal resistance, such as sulfates.
- Ability to perform elaborate, **user-specified oven heating profiles**.
- New HMI : **RockSeven®.**
- New interpretation software: **GEOWORKS®.**
- **New firmware and electronics.**
- **New instrumental hardware.**



→ *Rock-Eval 7S*

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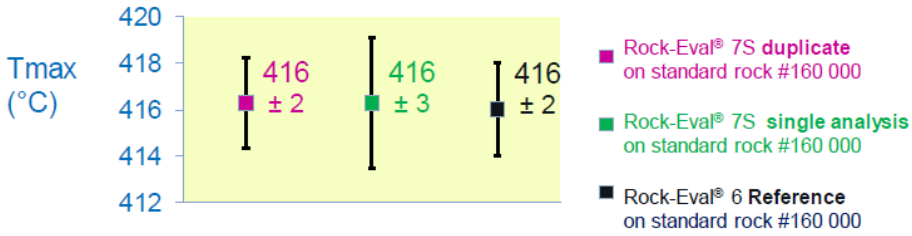
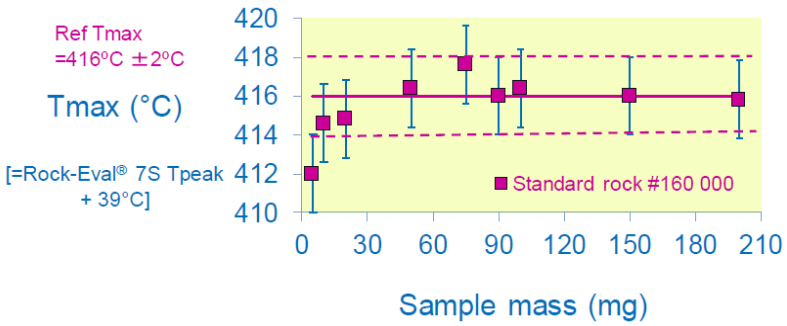
CONSISTENCY, LINEARITY & ACCURACY:

"Bulk Rock" and other methods associated with the Rock-Eval 7S allow the detection of Carbon and Sulfur simultaneously and during the stages of pyrolysis and oxidation. **Hydrogen containing compounds** are measured by a **Flame Ionization Detector (FID)**. **Oxygen-containing products** from both pyrolysis and oxidation ovens are measured by **infrared cells**. The **sulfur content** of the sample is quantified using an **UV cell** in addition to the classic Rock-Eval parameters. Dedicated ovens permit a **higher measurement accuracy**. Uniform and stable heating **minimizes analysis time and reduces experimental error**.

The performance of the method was statistically evaluated on the **main parameters**, through the criteria **of linearity, precision compared to Rock-Eval 6 and accuracy compared to elementary analysis** *(data presented at **IMOG 2019**)*.

Tmax:





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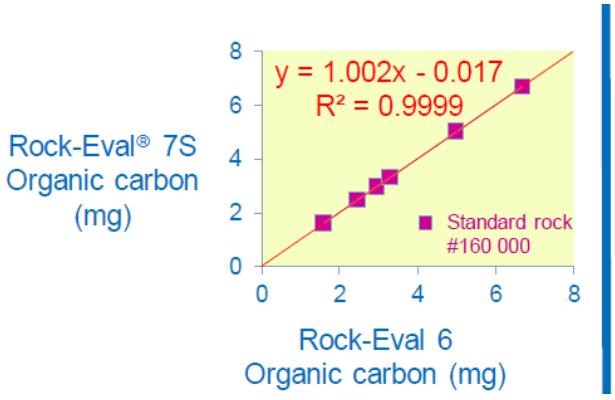

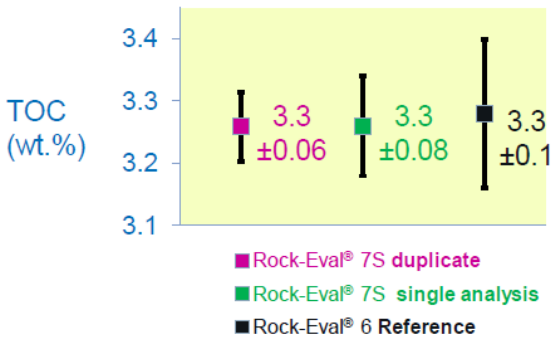

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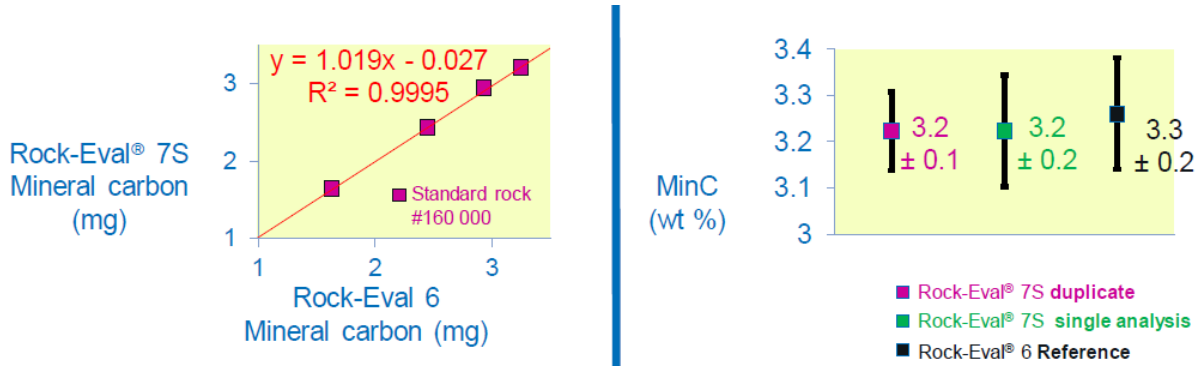
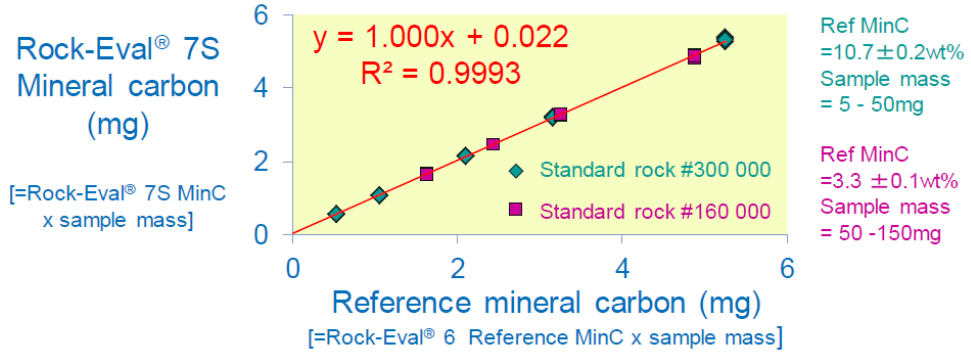
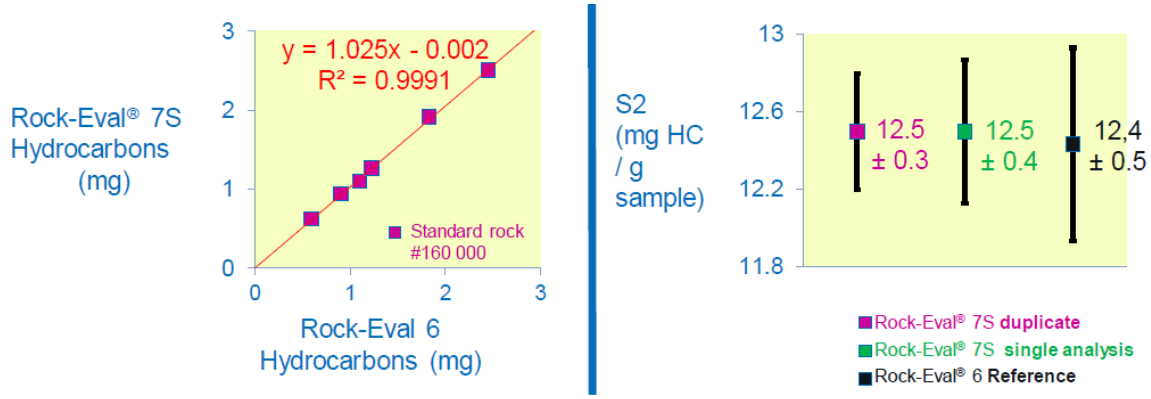
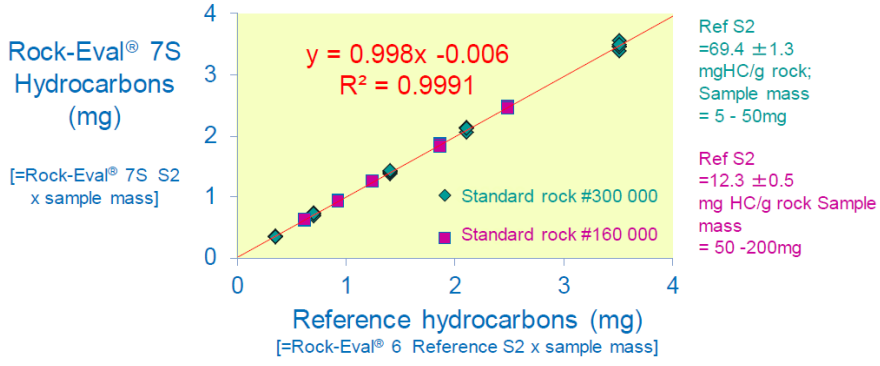
MinC:





S2:





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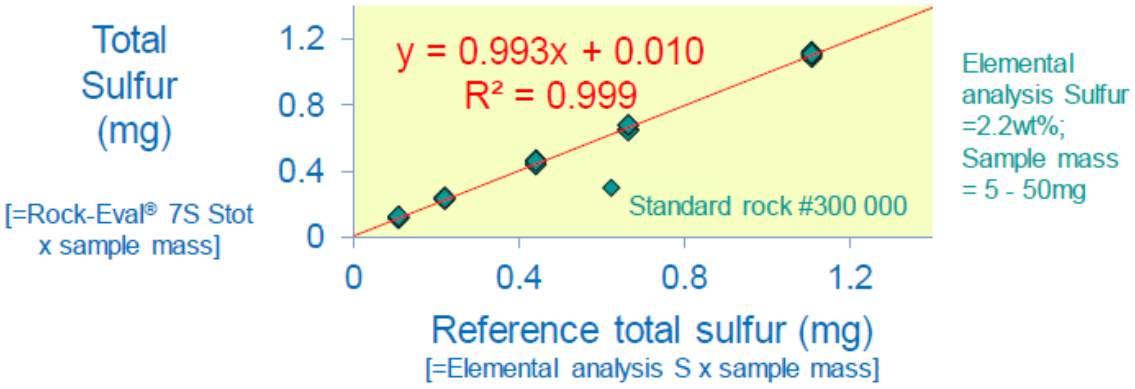
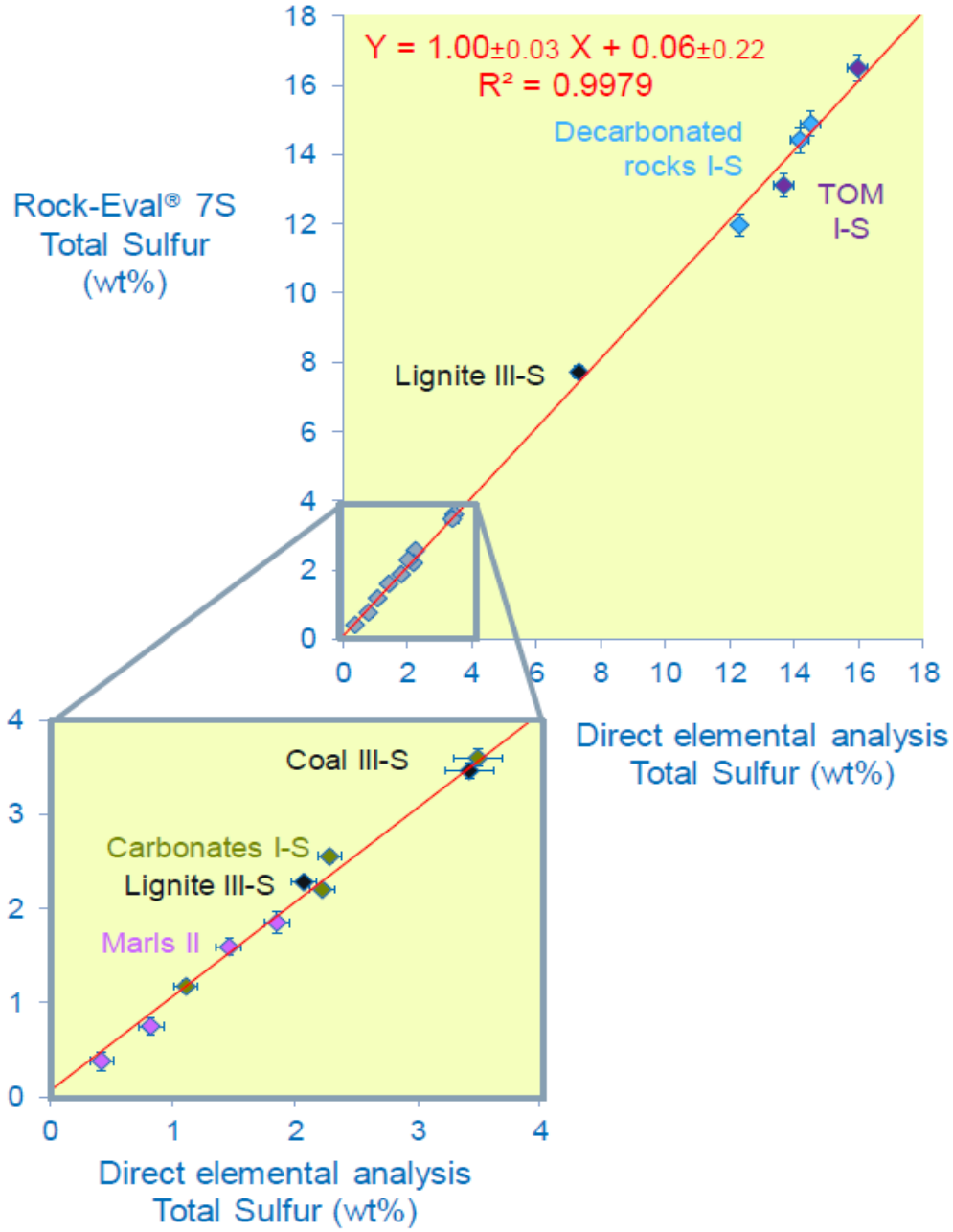
Total S:





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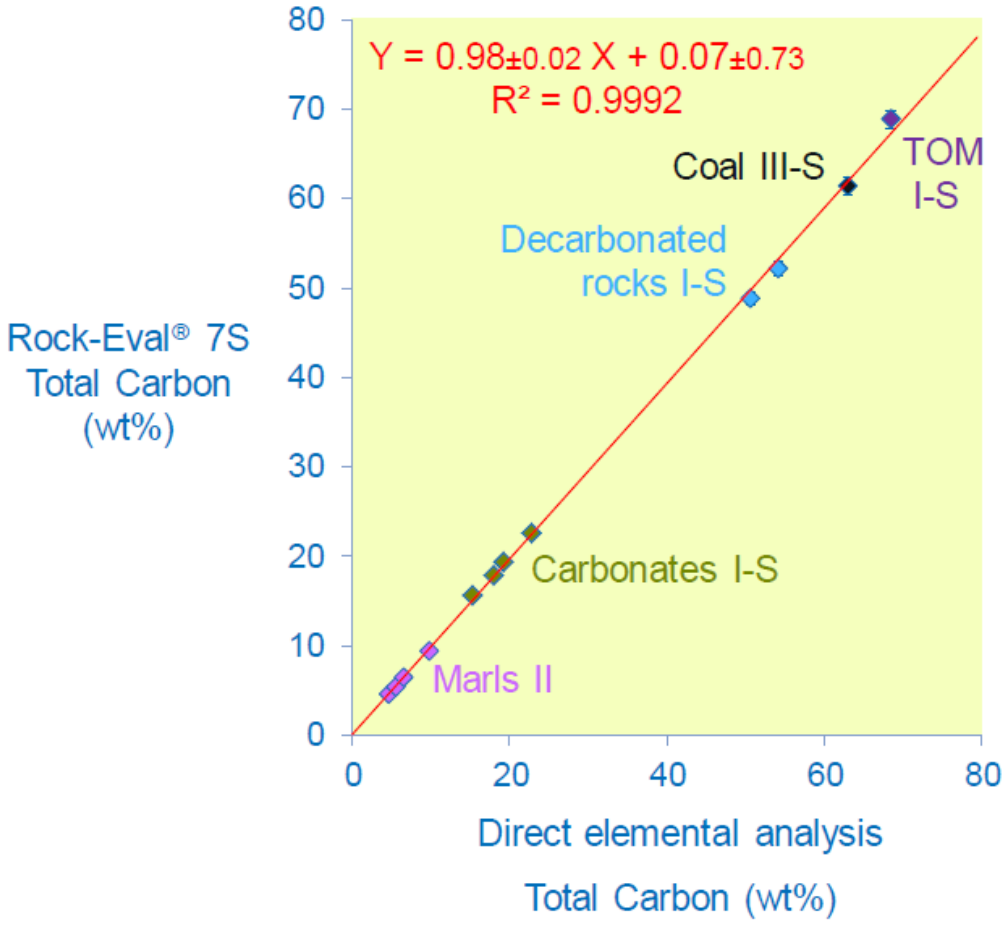

APPLICATIONS:

- **Oil exploration:** classical use of Rock-Eval for the screening of source rocks and reservoirs as well as basin modelling applications.

- **Gas shale exploration**: total quantities of gas generated and pyrolysis sulfur content allow a better selection of the layers to be exploited. The choice of a kinetics distribution (HC or S) representative of the bedrock levels is a key element for sedimentary basins modelling.

- **Reservoirs studies:** sulfur quantification is a valuable contribution to better understand the incorporation of sulfur in heavy products and to follow their evolution in the different parts of the reservoir. At greater depth, it is also useful for H2S risks diagnosis related to TSR (thermochemical sulfate reduction).

- **Refining sector:** quantitative analysis of organic sulfur in crude oils and a rapid determination of labile and / or refractory sulfur content.

- **Soil studies**: characterization of organic matter in different types of soils and the following of its early evolution in fallows.

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RESULTS AND CALCULATED PARAMETERS:

For bulk rock method:

- ✓ S1 - S2 - Tmax
- ✓ S3CO / S3CO2 (Pyrolysis Organic carbon)
- ✓ S4CO / S4CO2 (Residual Organic Carbon)
- ✓ S5 (Oxidation Mineral Carbon)
- ✓ Pyro Org S, Pyro Fe S, Residual S, Sulfate S, Total Organic S, Total S, etc.
- ✓ Total Organic Carbon (TOC)
- ✓ Total Mineral Carbon (MinC)
- ✓ Hydrogen Index (HI)
- ✓ Oxygen Index (OI)

For reservoir method:

- ✓ S1r - S2a – S2b- TmaxS2b
- ✓ S3CO / S3CO2 (Pyrolysis Organic carbon)
- ✓ S4CO / S4CO2 (Residual Organic Carbon)
- ✓ S5 (Oxidation Mineral Carbon)
- ✓ S1r Org S, S2 Org S, Residual S, Sulfate S, Fe S (pyrite), Total Organic S, Total S, etc.
- ✓ Total Organic Carbon (TOC)
- ✓ Total Mineral Carbon (MinC)
- ✓ Hydrogen Index (HIS2b)
- ✓ Oxygen Index (OIS2b)
- ✓ Light oil & Heavy oil
- ✓ NSO & API index

For gas shale method:

- ✓ S0 - S1'- S2'- S2"– TmaxS2"
- ✓ S3CO / S3CO2 (Pyrolysis Organic carbon)
- ✓ S4CO / S4CO2 (Residual Organic Carbon)
- ✓ S5 (Oxidation Mineral Carbon)
- ✓ S1r Org S, S2a Org S, S2b Org S, Residual S, Retained S, Sulfate S, Pyro Fe S (pyrite), Total Organic S, Total S, etc.
- ✓ Total Organic Carbon (TOC)
- ✓ Total Mineral Carbon (MinC)
- ✓ Hydrogen Index (HI)
- ✓ Oxygen Index (OI)

For pure oil method:

- ✓ S1r - S2a – S2b- TmaxS2b
- ✓ S3CO / S3CO2 (Pyrolysis Organic carbon)
- ✓ S4CO / S4CO2 (Residual Organic Carbon)
- ✓ S1r Org S, S2a Org S, S2b Org S, Residual S, Retained S, Sulfate S, Pyro Fe S (pyrite), Total Organic S, Total S, etc.
- ✓ Total Organic Carbon (TOC)
- ✓ Hydrogen Index (HIS2b)
- ✓ Oxygen Index (OIS2b)
- ✓ Light oil & Heavy oil
- ✓ NSO & API index

For kerogen method:

- ✓ S1 - S2 - Tmax
- ✓ S3CO / S3CO2 (Pyrolysis Organic carbon)
- ✓ S4CO / S4CO2 (Residual Organic Carbon)
- ✓ Pyro Org S, Pyro Fe S, Residual S, Sulfate S, Total Organic S, Total S, etc.
- ✓ Total Organic Carbon (TOC)
- ✓ Hydrogen Index (HI)
- ✓ Oxygen Index (OI)

For coal method:

- ✓ S1 - S2 - Tmax
- ✓ S3CO / S3 (Pyrolysis Organic carbon)
- ✓ S4CO / S4CO2 (Residual Organic Carbon)
- ✓ Pyro Org S, Pyro Fe S, Residual S, Sulfate S, Total Organic S, Total S, etc.
- ✓ Total Organic Carbon (TOC)
- ✓ Hydrogen Index (HI)
- ✓ Oxygen Index (OI)

For multi-heating rate method:

- ✓ Q1 to Q6 - Tpeak
- ✓ S3CO / S3CO2 (Pyrolysis Organic carbon)
- ✓ S4CO / S4CO2 (Residual Organic Carbon)
- ✓ S1r Org S, S2a Org S, S2b Org S, Residual S, Sulfate S, Pyro Fe S (pyrite), Total Organic S, Total S, etc.
- ✓ Total Organic Carbon (TOC)
- ✓ Total Mineral Carbon (MinC)
- ✓ Hydrogen Index (HI)
- ✓ Oxygen Index (OIS2b)

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