

Introduction

FOGL Digital Soil Calcimeter (FOGL), by BD Inventions P.C.

- Employed to determine carbon in inorganic mixtures and sediment samples (*Mineral Carbon*),
- Combined with CHNS to determine Total Organic Carbon (*TOC*), in sediment samples and the results are evaluated using Rock-Eval.

Definitions

- Mineral Carbon*: carbon of carbonate salts ($MgCO_3$, $CaCO_3$).
- TOC*: carbon of the organic matter.

Motivation

An important parameter which is used in Organic Geochemistry is the Total Organic Carbon (TOC) of sediment samples. TOC is usually determined via Rock-Eval or alternatively with acid treated samples in CHNS, the first being not readily available and the second time consuming.

A faster and handy method-procedure is needed. Here we propose the combination of FOGL and CHNS to determine organic carbon content for consistent and fast results.

Methodology

Analytical Instruments

FOGL Calcimeter: 1g of the sample reacted with 6ml HCl (6M). The pressure was measured and automatically converted to carbonate percentage which was translated to inorganic carbon percentage, (hold time: 5-10 min),



CHNS (Elemental Analysis): 10mg of the sample oxidized in oxygen atmosphere at 900°C,

Rock-Eval: 5mg of mixture samples and 50-70mg of sediment samples, firstly pyrolyzed in nitrogen atmosphere at 650°C and then oxidized at 850°C.

Two sets of samples

1st Set: 7 mixtures of $MgCO_3$ and $CaCO_3$ (Table 1).

Using FOGL Calcimeter, mixtures react with HCl, and the mineral carbon measured. The measured values were evaluated with those of CHNS and Rock-Eval.

Table 1: Mixtures of $MgCO_3$ and $CaCO_3$ in known concentrations.

	Mixtures	
	% $MgCO_3$	% $CaCO_3$
Mix 1	100	0
Mix 2	85	15
Mix 3	70	30
Mix 4	50	50
Mix 5	40	60
Mix 6	20	80
Mix 7	0	100

2nd Set: 10 sediment samples from different regions of Greece, which contain mineral and organic carbon analyzed.

Total Carbon Content (%)

- Directly measurements via Elemental Analysis CHNS

Mineral Carbon (%)

- Directly measurements via FOGL and Rock-Eval

Total Organic Carbon (%)

- Directly measurements via Rock-Eval
- Subtracting the result of FOGL (mineral carbon) from total carbon content of CHNS.

Acknowledgment

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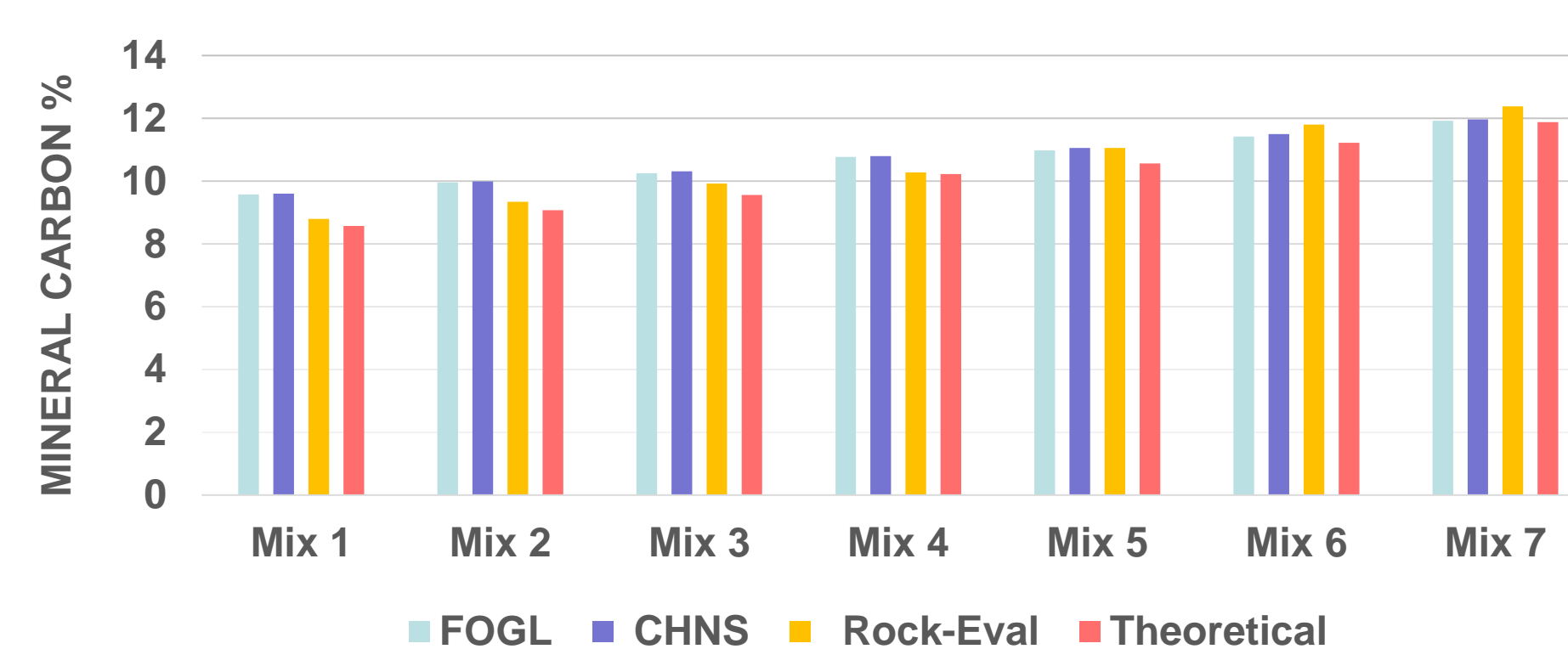
Results

1. Mineral Carbon

1.1 Inorganic Mixtures

- The measured values of mineral carbon are comparable and satisfactory between FOGL, CHNS and Rock-Eval.
- All values are very close to the theoretical one.

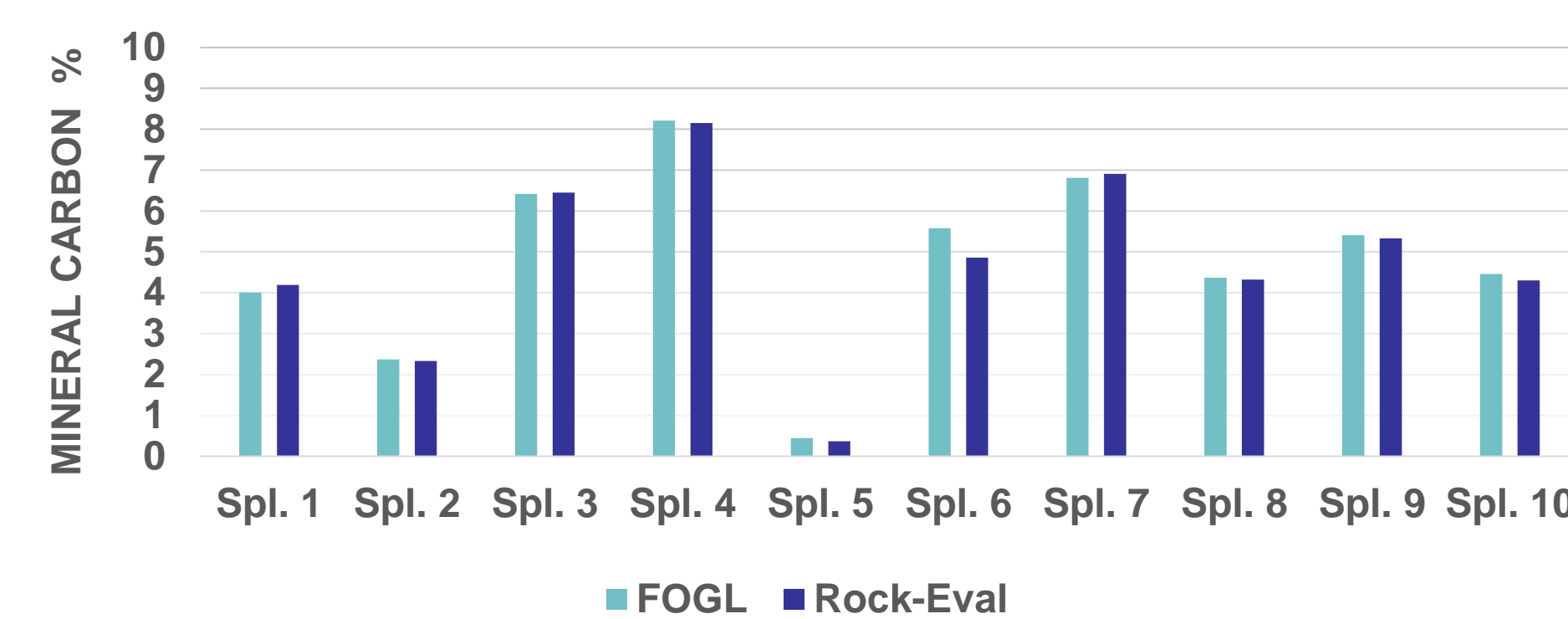
The FOGL Digital Soil Calcimeter gives precise and reliable results in terms of carbon content. The estimated uncertainties in the FOGL results are $\pm 0.1\%$, based on comparison of triplicate runs of the same sample.



1.2 Sediment Samples

- The measured values of mineral carbon in the sediment sample compared to those of Rock-Eval are remarkably consistent.
- Both instruments can identify mineral carbon even if its percentage is very low (0,5%).

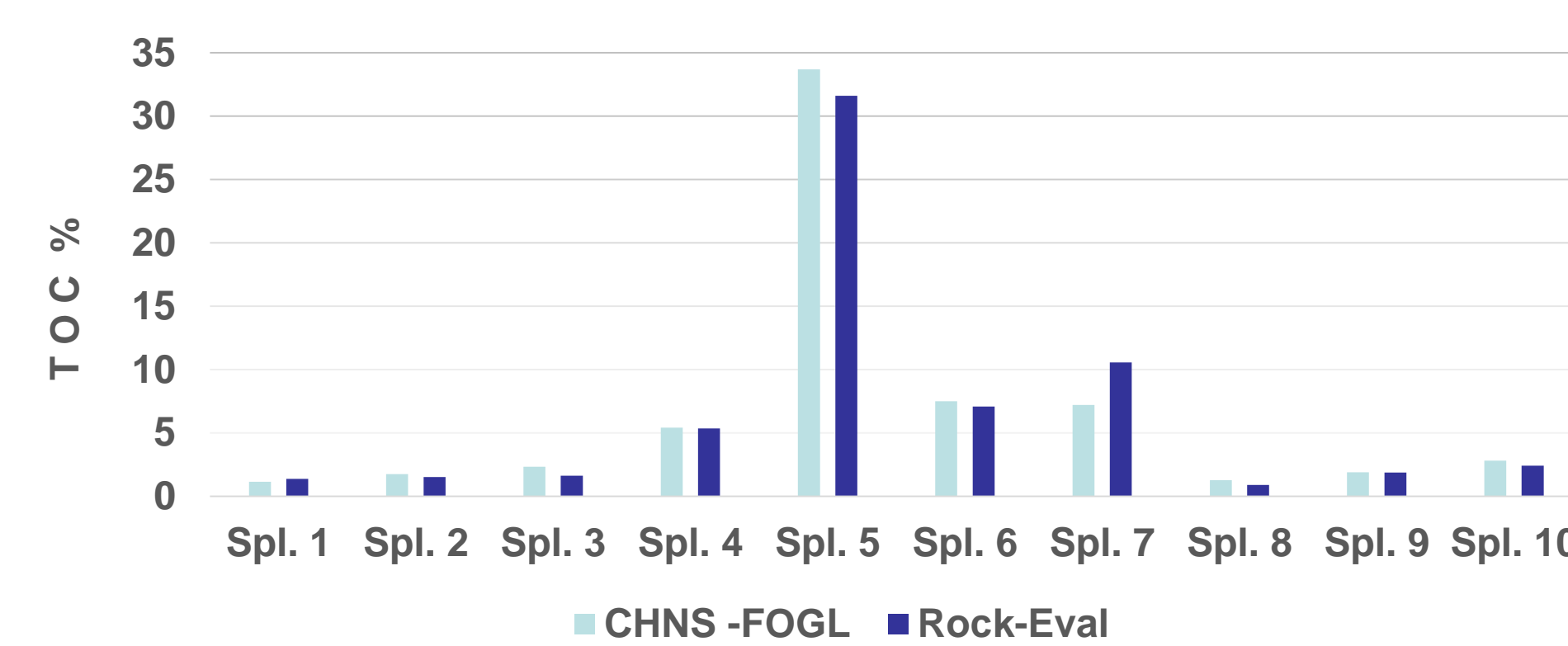
Therefore, FOGL provides precise results in terms of mineral carbon content in sediment samples.



2. Total Organic Carbon (TOC)

2.1 Sediment Samples

- Values of TOC determined by FOGL-CHNS combination are reliable with the Rock-Eval, (small deviations are acceptable because Rock-Eval is a very specialized instrument).
- Both cases can identify TOC even if its percentage is very low (1%).



Conclusions

- The performance of the *FOGL-CHNS Method Combination* for Mineral and TOC determination was studied.
- Mineral carbon* of 7 mixtures ($MgCO_3/CaCO_3$) and 10 sediment samples were measured using FOGL, CHNS and Rock-Eval and the final results were very satisfactory.
- TOC* of sediment samples using FOGL-CHNS combination and Rock-Eval was evaluated and demonstrated that both techniques provide consistent analytical results for TOC content.

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References

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