Petroleum Geochemical studies in Greece

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Petroleum Geochemistry today

- **Petroleum geochemistry plays an important role in every phase of petroleum exploration and production**
- **Generation, migration, accumulation, production, environmental impact**
- **Each stage affects petroleum composition**
- **Compositional changes reveal significant information**

Petroleum Geochemistry activities at TUC

Goal: to provide highly specialized analyses of crude oils and source rocks for research and education

- Characterization of the depositional environment
- Evaluation of petroleum generation potential, thermal maturation, biodegradation level
- Analysis and interpretation of biomarkers in crude oils and sediments' extracts
- Oil-oil and oil-source correlations

Petroleum Geochemistry equipment

- ✓ Rock-Eval
- ✓ Elemental analysis (CHNS-O)

Petroleum Geochemistry equipment

- ✓ soxhlet extraction (source rock/sediments/so
- ✓ asphaltene precipitation
- ✓ column chromatography (separation)

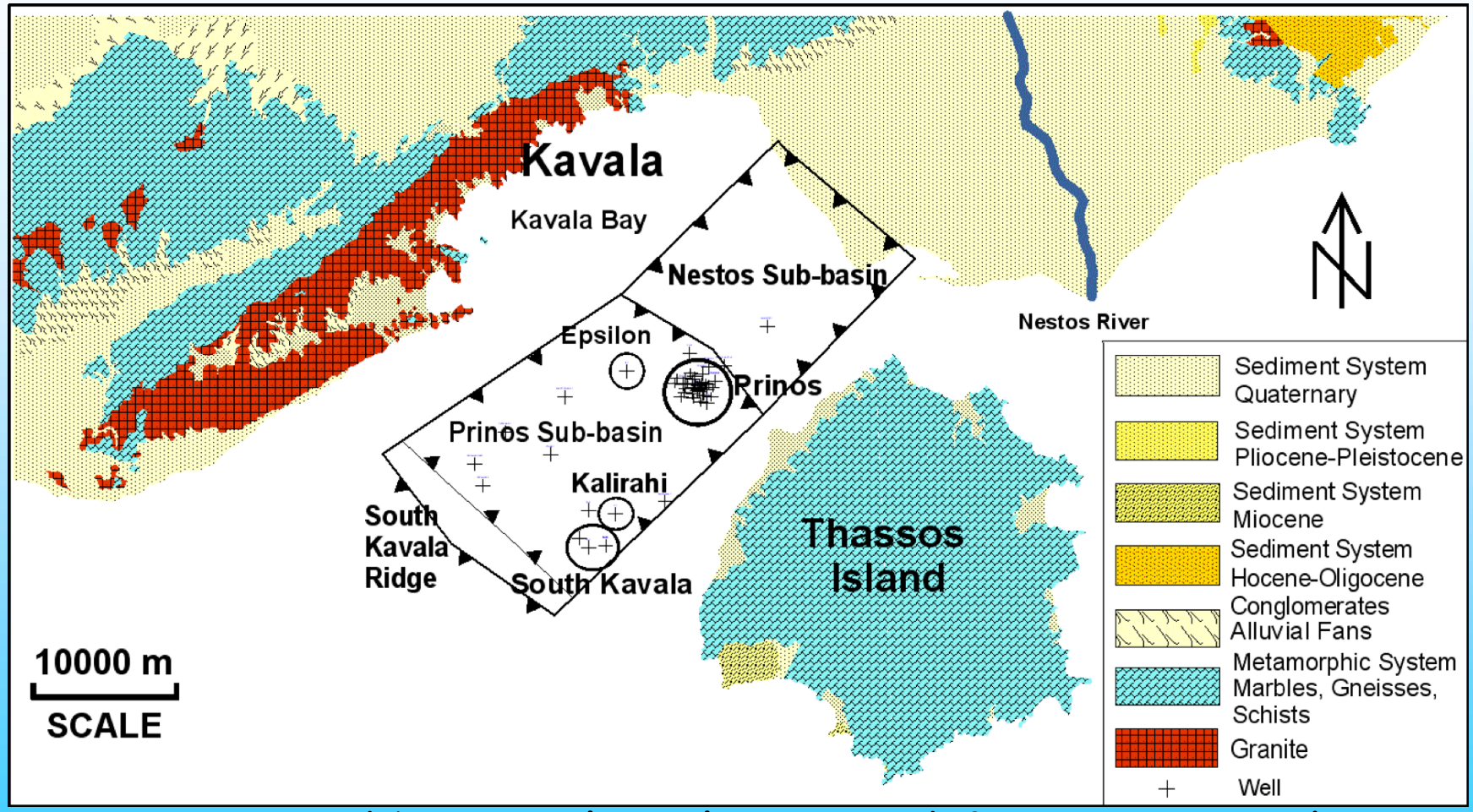
Petroleum Geochemistry equipment

- ✓ high-resolution gas chromatography (GC-FID)
- ✓ gas chromatography-mass spectrometry (GC/MS)
- ✓ pyrolysis-gas chromatography (Py-GC)

Petroleum Geochemistry projects at TUC

- ✓ **Geochemical study of Prinos basin**
- ✓ **Geochemical study of neogene formations in central Crete**
- ✓ **Environmental protection studies**

Geochemical study of Prinos basin



Supported by Kavala Oil S.A. and GSRT research project 05 ΠΒΑΜΘ19

Geochemical study of Prinos basin

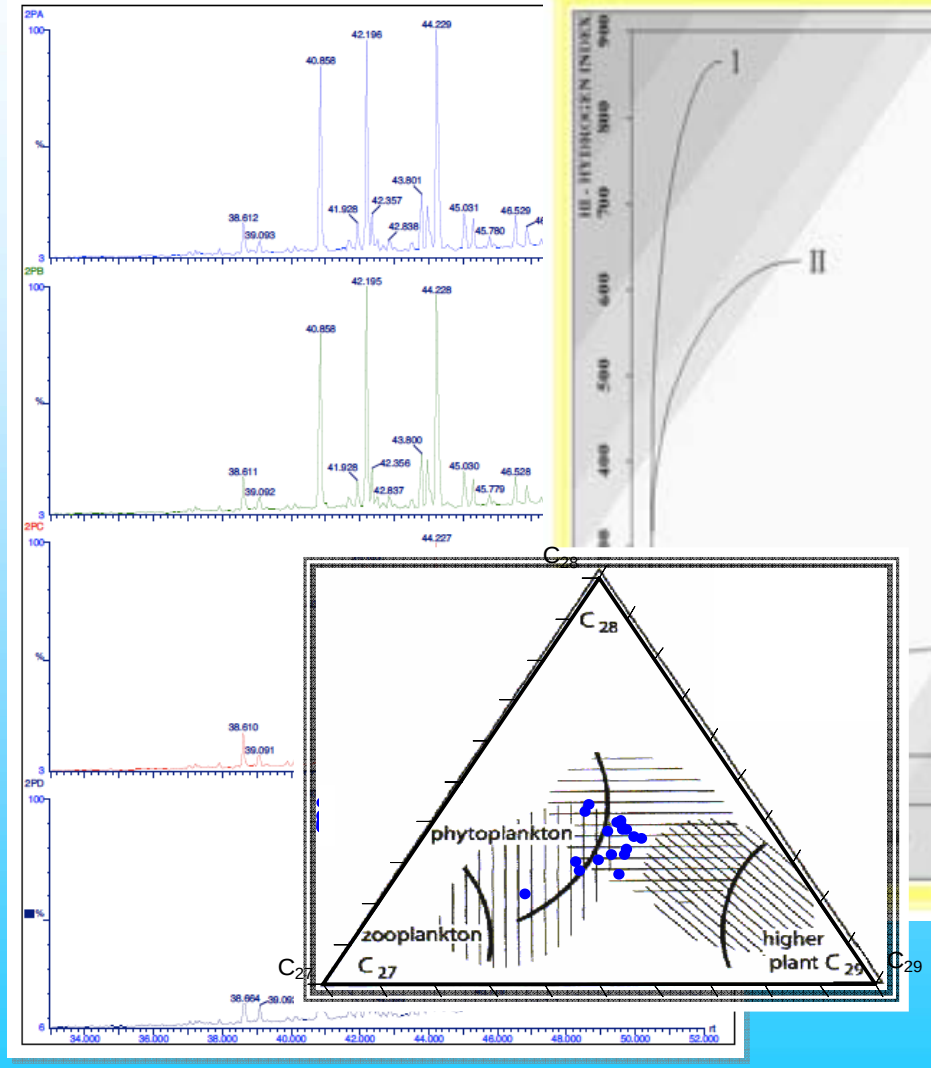
Samples

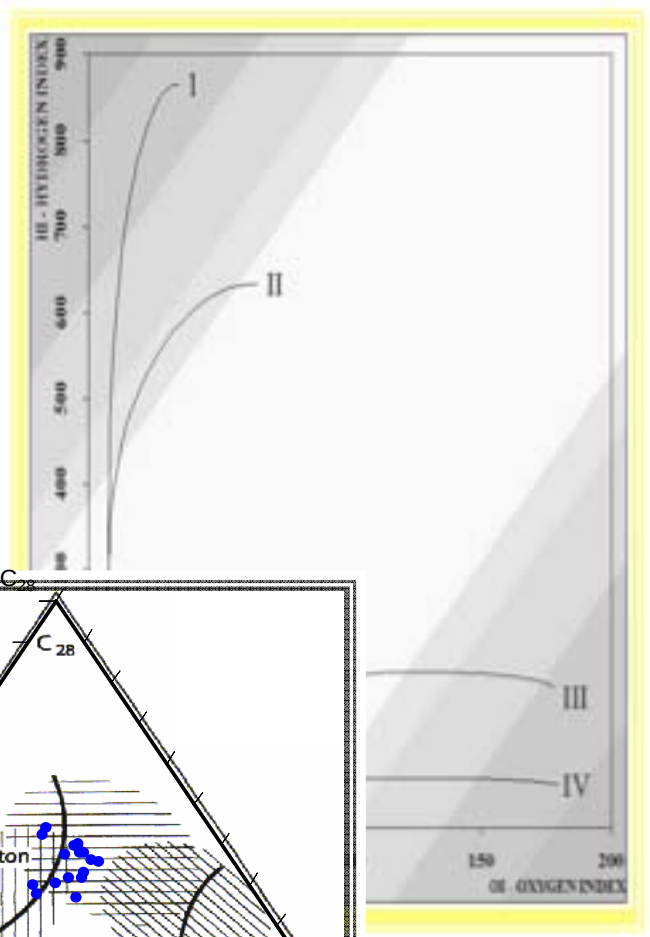
120 core samples from three reservoirs (Prinos, North Prinos, Epsilon)

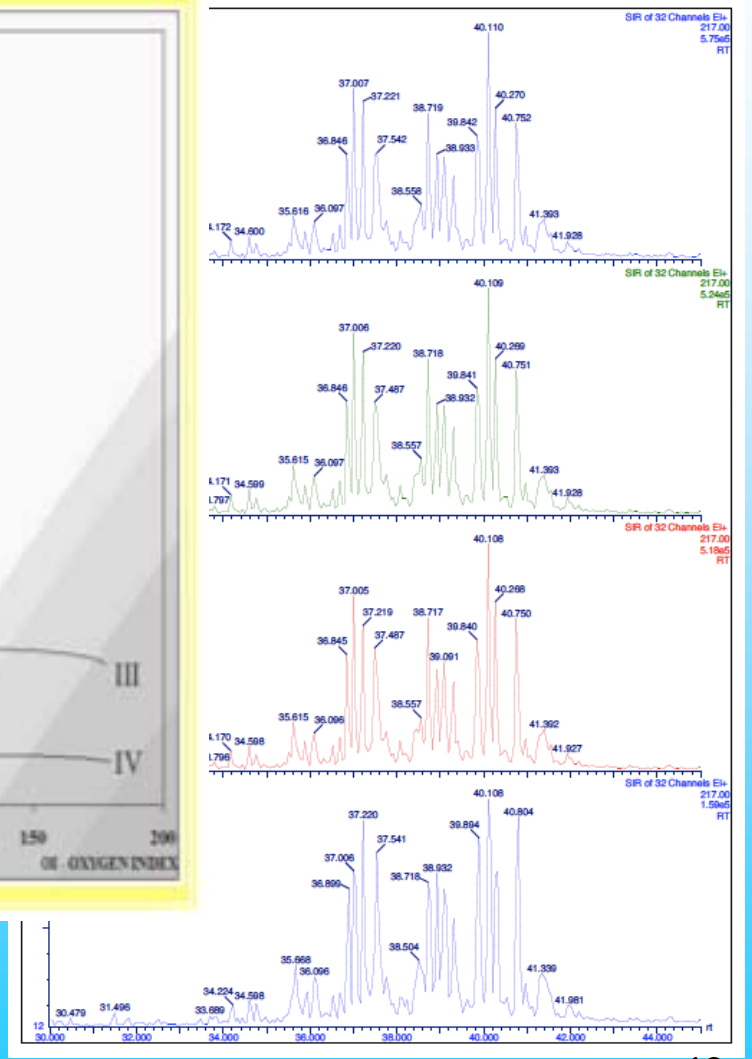
Methods

Rock-Eval analysis
Elemental analysis
Core extraction
Group type fractionation
GC analysis of the saturate fraction
GC-MS biomarker analysis

Geochemical study of Prinos basin







Hopanes m/z 191

Steranes m/z 217

Geochemical study of Prinos basin

✓Prinos, Prinos North and Epsilon fields show similar depositional environment during sedimentation (hypersaline, strongly reducing conditions)

✓Similar non-biodegraded organic matter

✓Epsilon and Prinos samples show a clear even to odd carbon number predominance of n-alkanes (marine organic matter). The opposite is true for Prinos North (higher plant, terrestrial organic input)

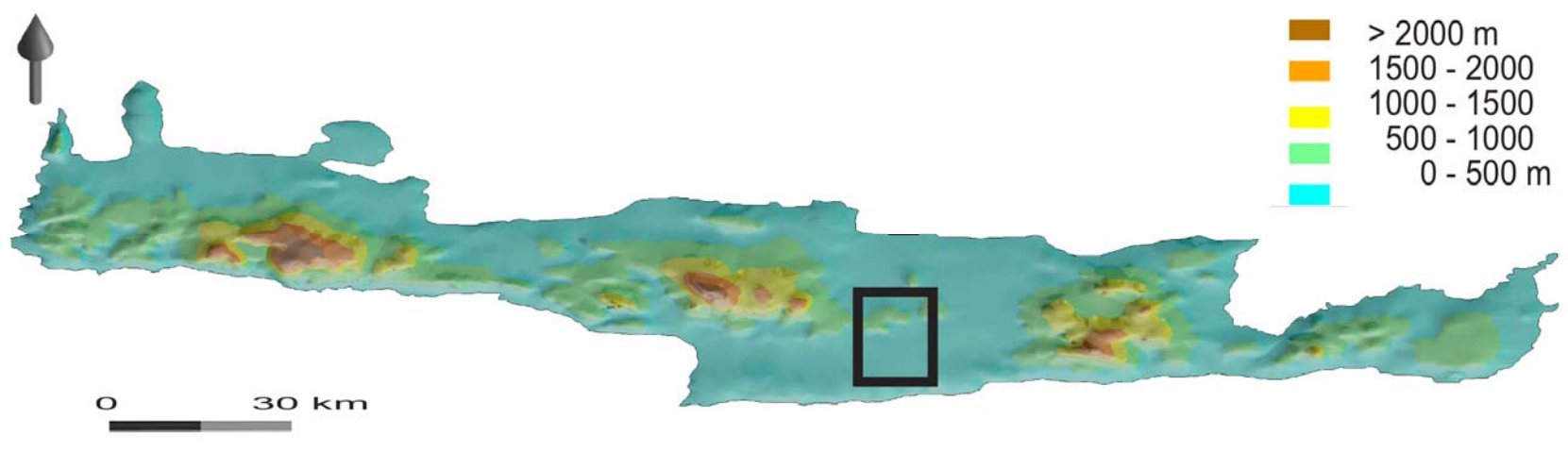
✓Different thermal maturation levels according to Rock-Eval Pyrolysis and group type composition

and much more presented in:

P. Kiomourtzi, N. Pasadakis, A. Zelilidis. "Source Rock and Depositional Environment Study of Three Hydrocarbon Fields in Prinos – Kavala Basin (North Aegean)", Open Petroleum Engineering Journal, 1 (2008) 16-29

P. Kiomoutzi, N. Pasadakis, E. Manoutsoglou, A. Zelilidis, K. Papakonstantinou. "Source organic matter and depositional environment in Prinos oil basin (Greece)", International Geological Congress, Oslo, 6-14 August 2008.

Geochemical study of neogene formations in central Crete



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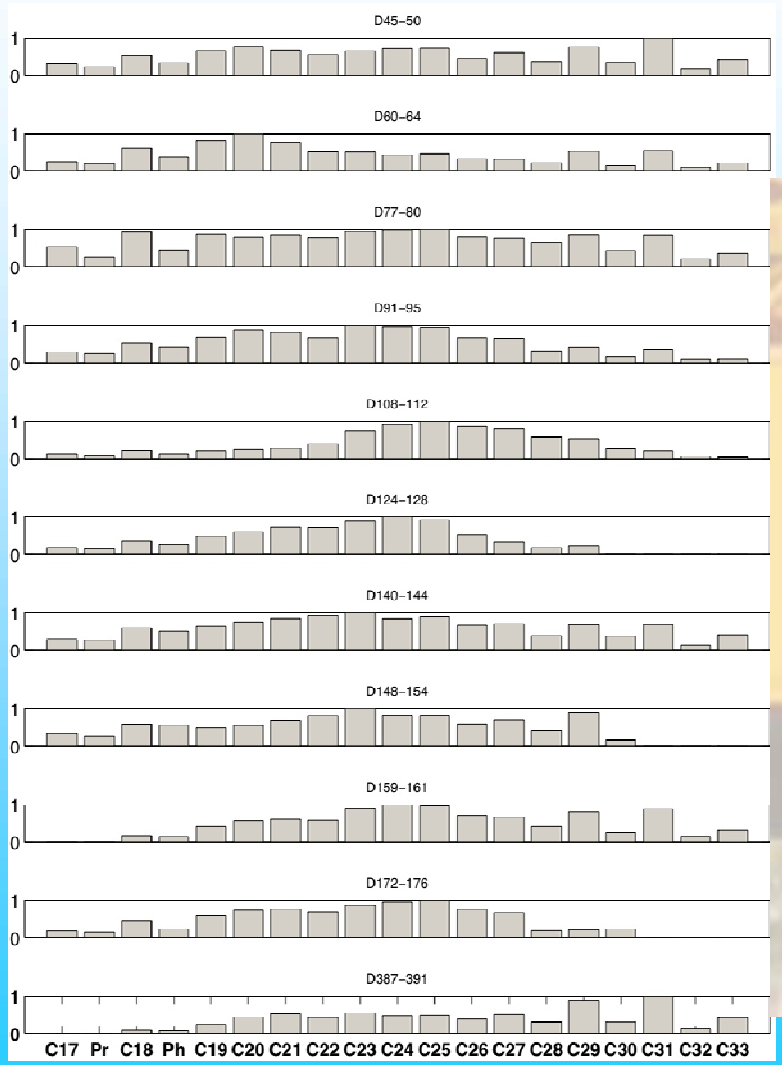
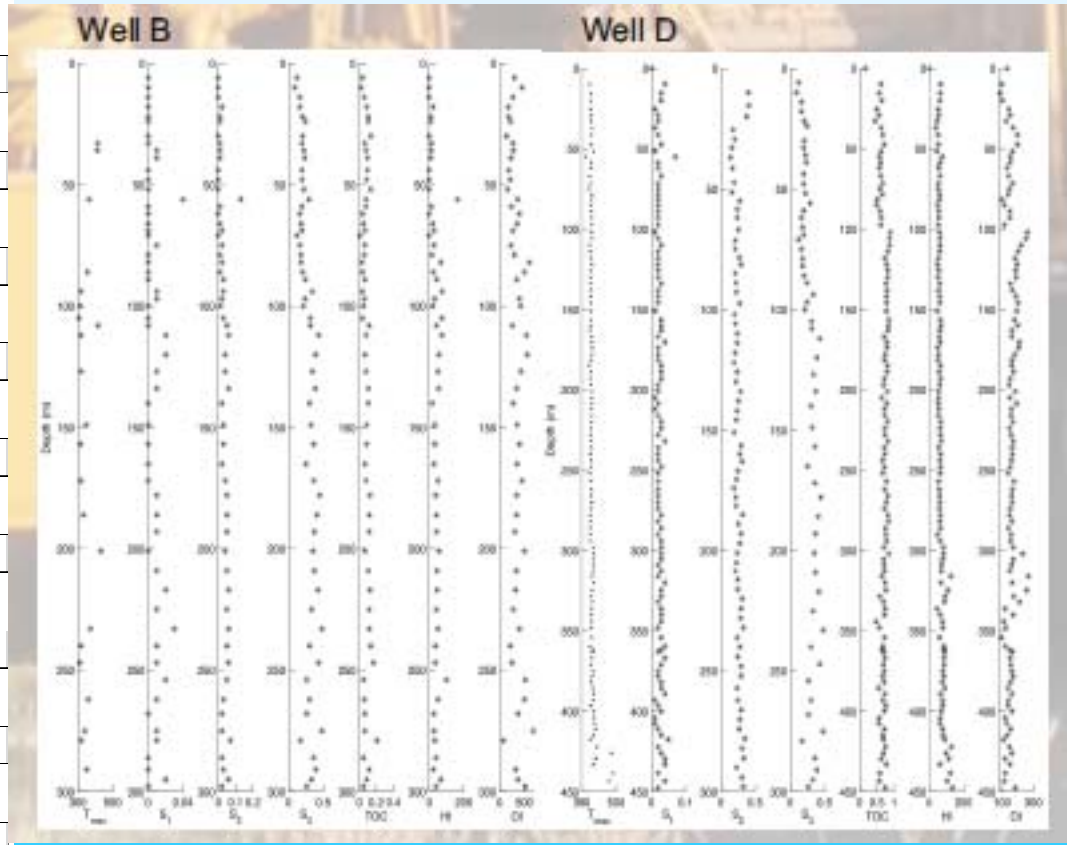
Geochemical study of neogene formations in central Crete



GC profiles of n-alkanes



Rock-Eval data n-alkanes

Geochemical study of neogene formations in central Crete

- ✓Immature organic matter (diagenesis stage)
- ✓Depositional environment: lacustrine, lagoon
- ✓The organic matter content in sediments increases with the depth, and according to analogous literature data, it can serve as the source of the produced methane (biogenic)

and much more presented in:

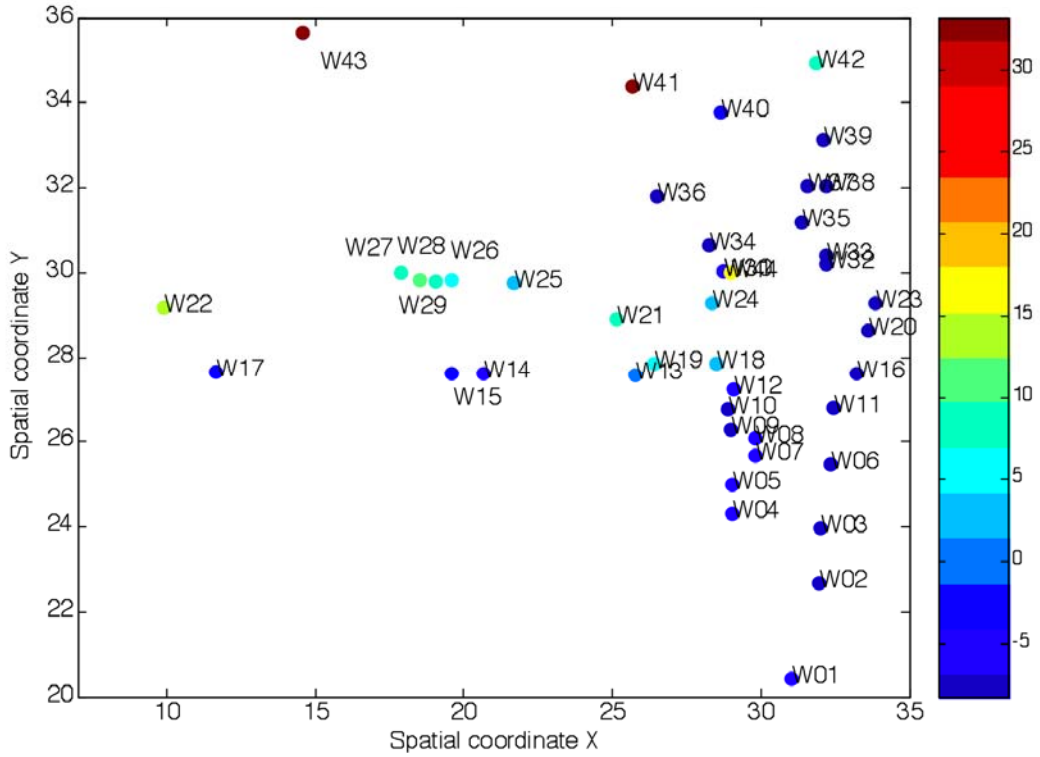
Nikos Pasadakis, Emmanuel Manoutsoglou, Avraam Zelilidis, Maowen Li. "Source rock geochemical study of shallow biogenic methane accumulations in Crete (Greece) island, 24nd International meeting on Organic Geochemistry, Bremen Germany, 6-11 Sept. 2009, p. 466

N. Pasadakis, V. Dagounaki, A. Zelilidis, G. Papatheodorou, E. Manoutsoglou. "Organic matter of neogene sediments in central Crete (Greece), as source of biogenic methane", International Geological Congress, Oslo, 6-14 August 2008

Petroleum Geochemistry as a tool in environmental protection

- ✓ Fingerprinting: determination of the origin of petro-chemical pollutants
- ✓ Monitoring the fate of hydrocarbons in polluted areas

Fingerprinting: determination of the origin of petro-chemical pollutants

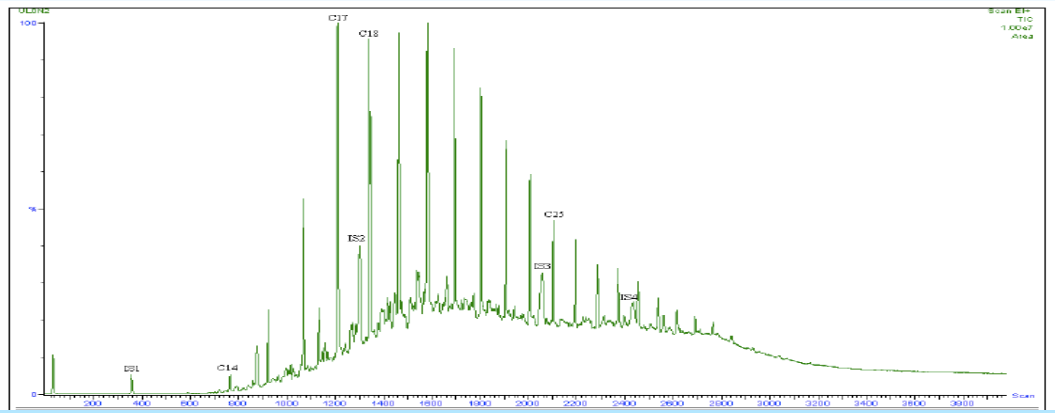


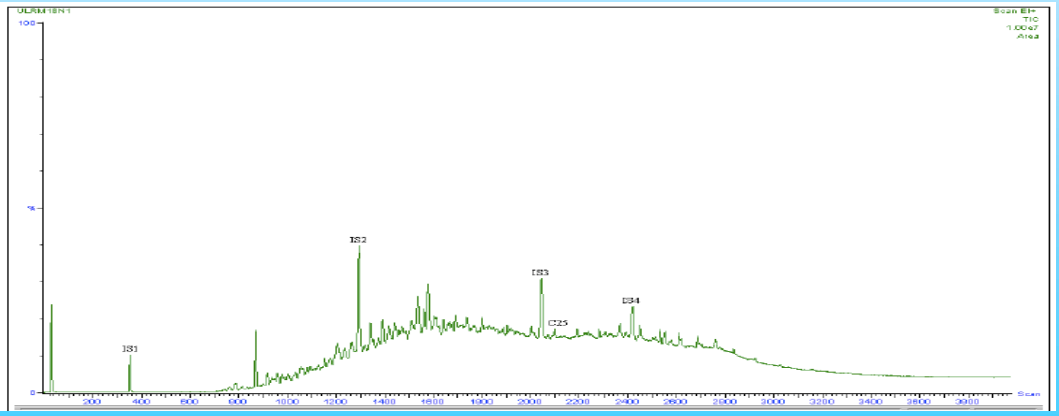
The distribution of different fractions in the sub-surface of an oil-refinery based on compositional data and chemometrics

Supported by "Hellenic Petroleum"

Nikos Pasadakis, Evangelos, Gidarakos, Georgia Kanellopoulou, Nikos Spanoudakis: "Identifying Sources of Oil Spills in a Refinery by Gas Chromatography and Chemometrics. A case study", Environmental Forensics, 9 (2008) 33-39.

Monitoring the fate of hydrocarbons in polluted areas





Compositional changes in petroleum due to the biodegradation.

To improve remediation in petroleum polluted areas

Marta Ruiz, Nikos Pasadakis, Nicolas Kalogerakis: "Bioremediation and toxicity determination of natural seawater polluted with weathered crude oil by salt-tolerant consortia in a SBR", Marine Pollution Bulletin, 52 (2006) 1490-1493

Petroleum Geochemistry education at TUC

Courses:

Undergraduate:	✓ Fossil Fuels
	✓ Organic Geochemistry
Postgraduate:	✓ Environmental impact of hydrocarbons production
Diplom works:	7
MS thesis:	Petroleum source-rocks in Greece. A comparative study
PhD thesis: (on-going)	Biodegradation pathways in deep reservoirs. The case of Willinston Basin (North America)

Our international collaborations in Petroleum Geochemistry

Geological Survey of Canada

Department of Geological and Environmental Sciences, Ben-Gurion University, Israel

University of Belgrade, Serbia

Thank you