

AAPG **EXPLORER**

FEBRUARY 2018

The End of Fossil Fuels in Europe?

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ICE Field Trips Provide Rare Opportunity



Field trip group looking at the Lower Jurassic section at stop 10 (Peniche, 70 kilometers north-northwest of Lisbon). These marine marly limestones are one of the main source-rocks of the Lusitanian Basin and have sourced oil-seeps visited at stop 7. Photo by G.Garcia.

As the lights went out on the AAPG International Conference and Exhibition in London late last year, the field trip leaders reported back their experiences from visiting classic geology localities in the United Kingdom and Europe.

With ICE in one of the most iconic European capitals, the organization committee wanted to shape an ambitious field trip program that would look beyond the British Isles. Against all odds dictated by the unfavorable state of the industry,

three field trips accompanied from start to end the success of ICE in London, two of which are detailed below.

Portugal

Nuno Pimentel and Rui Pena dos Reis reported from the Lusitanian Basin in Portugal:

The Lusitanian Basin, located in the Western Iberian Margin, provides a unique opportunity to look at an extensively exposed North Atlantic Margin. This,

complemented by great landscapes and a mild Portuguese autumn, brought a good number of attendees to this field trip, the only one to have taken place outside the U.K.

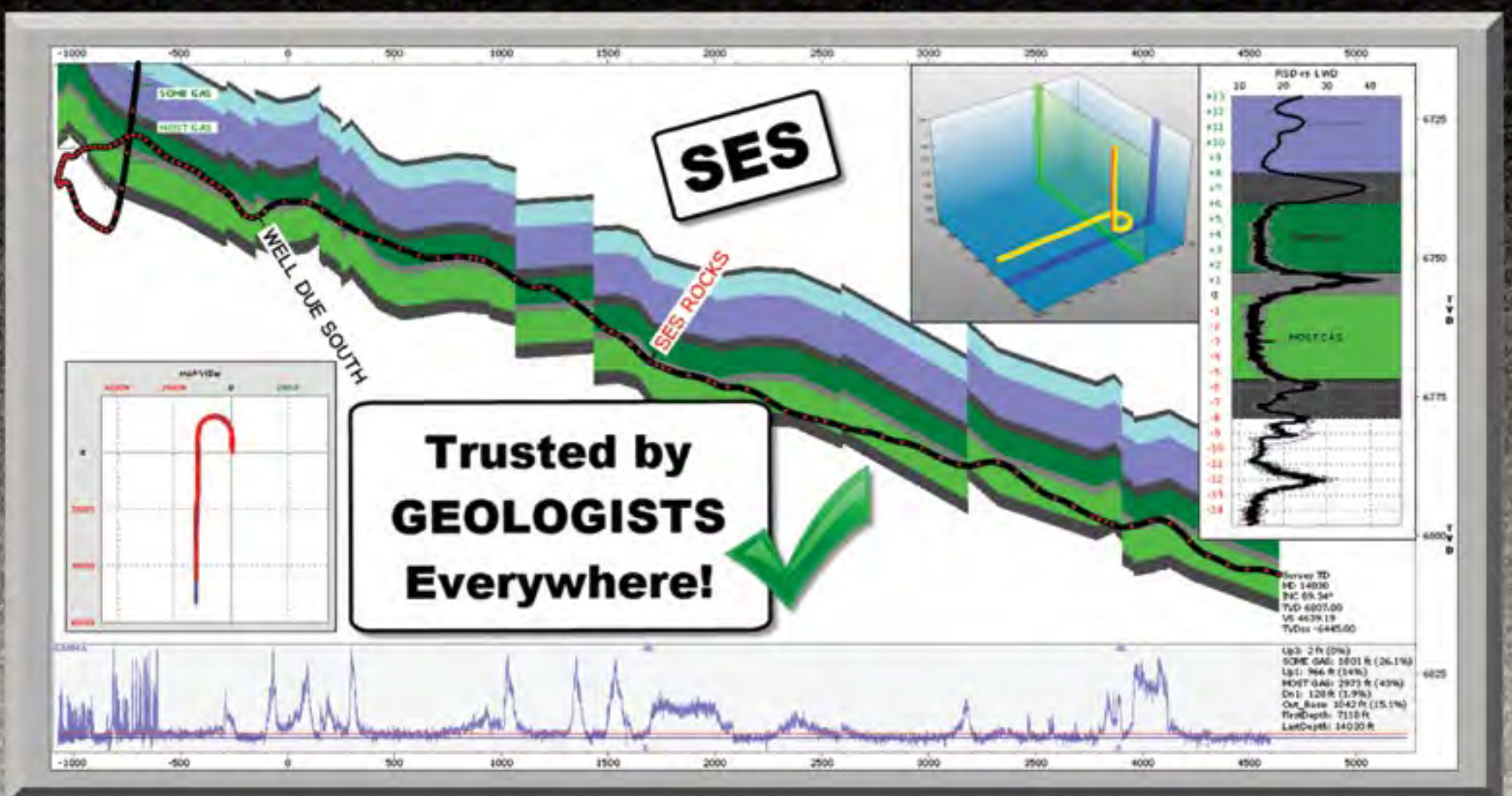
Thirteen professionals from different companies joined us for a three-day field trip looking at significant geologic features of the three major petroleum systems of the Lusitanian Basin, namely the Silurian black-shales and Triassic siliciclastic reservoirs, the Pliensbachian marine source rock and Lower Cretaceous siliciclastic

reservoirs, and Oxfordian lagoonal source rock with Upper Jurassic carbonate and siliciclastic reservoirs.

The visit has been based in large outcrop observations, mostly along coastal cliffs. Selected seismic lines, well data and geochemical analyses have also been shown and discussed. Geodynamic evolution, basin architecture and salt tectonics (including seismic scale piercing diapirs) have been presented. Overall, the

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Jonny Imber leading discussion of the plumose marking and arrest lines on one rather magnificent fracture within the Bituminous Shales of the Whitby Mudstone Formation. Photo by Susie Daniels.

England
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attendees had the opportunity to approach different source rocks, reservoirs, seals and traps, as well as their spatial and time-relations, within a rift-to-drift framework.

Weather conditions were excellent for the season (up to 90 degrees Fahrenheit and no wind) and the atmosphere was quite enjoyable, promoting the discussion with the field trip leaders and also within the group. We had excellent feedback from everyone and we hope that these three days will stay in their memories and might also bear fruit along the exploration challenges of those who visited us.

England

Susie Daniels, Jonny Imber and Michael Mawson reported from the Fractured Reservoirs field trip in northeast England:

Experiencing an authentic (mild but damp) English autumn, 13 professionals from six different companies visited fractured reservoir localities in northeast England. We examined fracturing in both comparatively homogeneous and heterogeneous sequences, the shale-rich Lower Jurassic (Lias Group) Whitby Mudstone Formation and carbonates of the Upper Permian (Zechstein Group) Roker Formation, respectively, and considered the impact of faults and fractures on fluid flow.

With a total organic carbon approaching 20 percent, the Jet Rock of the Whitby

Mudstone Formation in the Cleveland Basin represents source rock/shale oil reservoirs and seal units, and is an analogue for the less well-exposed Weald Basin in southern England, and the time equivalent Posidonia Shale in the Netherlands and southwest Germany. Exposures on clean, wave-washed platforms and in cliff sections provided the basis for discussions on the lateral and vertical variation in natural hydraulic fractures, mechanical boundaries and interaction between fractures.

The unabating rain proved too much for the final outcrop, but didn't dent enthusiasm for evening dialogue, which began with seismic sections and well logs in preparation for the Zechstein carbonates.

The Zechstein carbonate rocks of northwest Europe are hydrocarbon reservoirs from the northern North Sea to Poland, and include some of the oldest fields to have been discovered and produced. The spectacular exposures of mainly shallow water (platformal) carbonates in northeast England have undergone varying diagenesis, including dramatic collapse brecciation caused by evaporite dissolution during uplift and exhumation. The variation in fracture properties linked to facies, faulting and evaporite dissolution were evident and could have borne much longer examination in the County Durham sun.

Overall the trip benefited from the expertise, enthusiasm and interest of the participants, providing much discussion amongst the group.

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how the oil will react with different compositions of injected gas."

"We're in the early innings with this. We're still trying different things," he added.

"Our role is to validate the process in the lab, getting the right engineered gas in contact (with) a specific oil. In the lab, we've demonstrated that we can recover incremental oil with multiple cycles," he explained.

Traditionally, EOR efforts begin late in the life of a field.

"Maybe we don't need to wait so long. Perhaps we can change the shape of the decline curve if we start at midlife or earlier," Bruno said.

Eagle Ford and Beyond

Last year, Core Laboratories announced the formation of a multi-company consortium in the Eagle Ford to pursue the technology, and Core is looking forward to working in other basins.

"That's high on our list of conversations right now," Bruno said.

The consortium approach benefits companies who are able to view shared results he said.

"Some clients have done rudimentary field injection projects. We get feedback and that directs additional lab work," Bruno said.

Bruno said the technology will be useful in many areas, with some horizons in the Permian already under investigation.

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