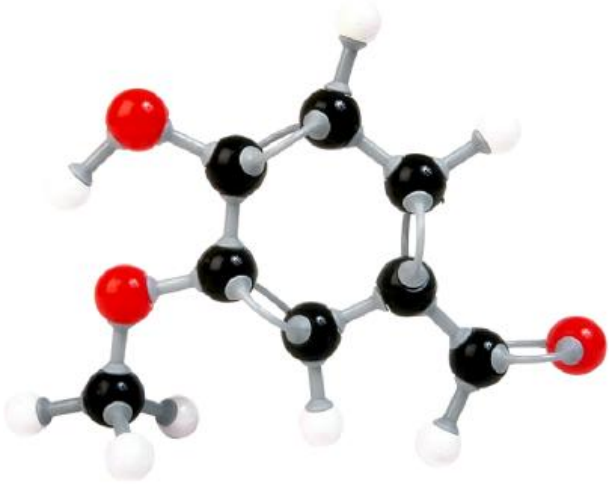
Adrok™

Predrilling Virtual Logging™



Novel Electromagnetic Imaging & Rock Classification of the Subsurface

PETEX 2010

Objectives

- Introduce new geophysical technology

  - Adrok® Scanner

- Present Case Studies as field proof

  (1) Onshore, USA (oil field)

  (2) Onshore, UK (coal bed methane field)

Who are we?

Adrok uses advanced technology to supply geophysical services for locating, identifying and mapping subsurface natural resources (oil, gas, water and minerals).

We call our services *Predrilling Virtual Logging* .

+30 Years of Research!

Dr G. Colin Stove - **serial-inventor**

- PhD & Academic in Geography Dept. at the University of Aberdeen
- At Macaulay Institute helped develop a unique machine-vision system (called MAPIPS and GEMS) for automated photogrammetric mapping & intelligent classification of terrain and subsurface stratigraphy from ground, aerial and satellite or spaceborne platforms.
- ESA, NASA & NATO Principal Investigator
- Co-founder of commercial space-research company, sold to BAE
- Founder of Ground Penetrating Radar company, sold to Drilling Co.
- Inventor of scientific principles of Atomic Dielectric Resonance (ADR)
- ADR is patented & exclusively licence to Adrok to commercialise ADR
- Dr Stove is Founding Shareholder & Director of Adrok

Introduction to new geophysical technology for finding subsurface Hydrocarbons & Minerals:

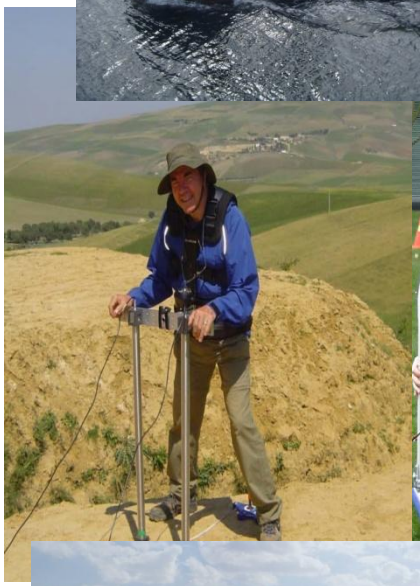
Adrok® Scanner

Adrok® Scanner

- What is it?
  - New entrant in the subsurface imaging market for oil, gas and minerals E&A
- What is its purpose?
  - To help locate, identify & map gas, oil, minerals & water from the surface & therefore help reduce drilling dry holes
- What does it deliver?
  - Generates “Virtual Borehole” logs of subsurface geology from surface – without drilling!

Field Deployment



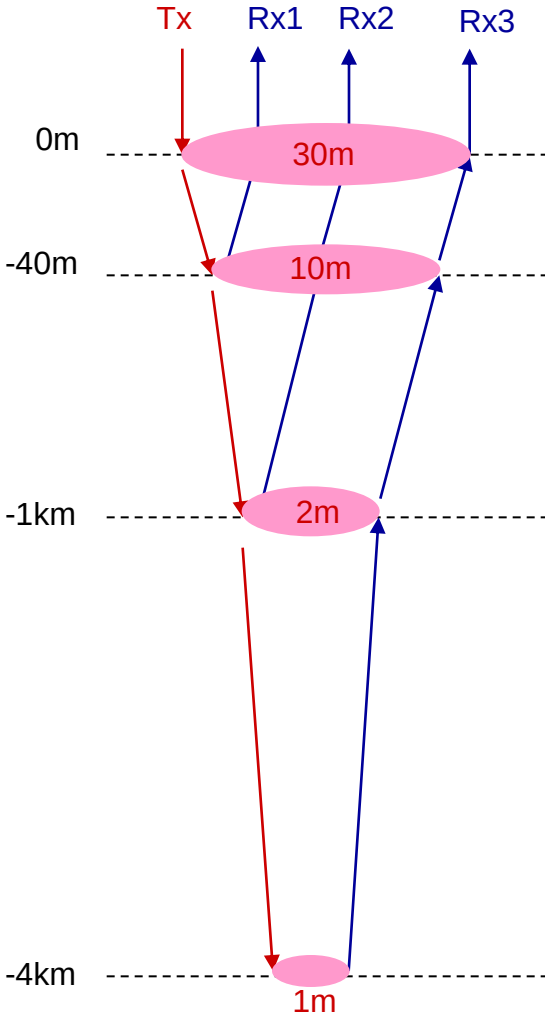



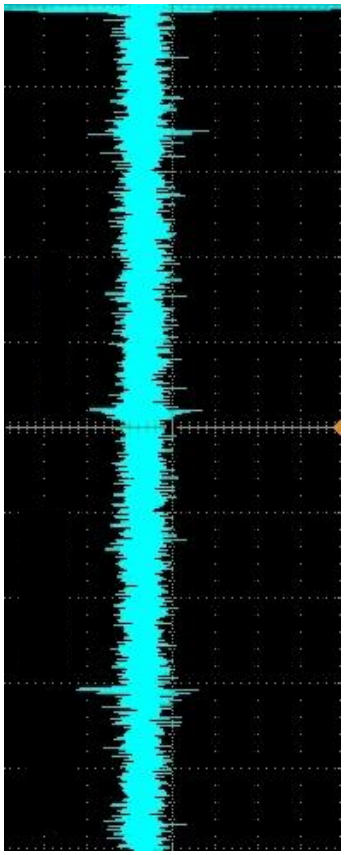





Subsurface Scanning Process

- Adrok Scanner Illuminates the ground by Transmitting & Receiving Invisible Lased Light beams of Electromagnetic energy
  - Pulsed
  - Coherent (over a narrow band of frequencies)
  - Collimated (cylindrical shape)
  - Radiowaves, Microwaves
  - Resonant frequencies
  - Measured beam dispersion
- Penetrates from ground surface to proven depths of up to 4km



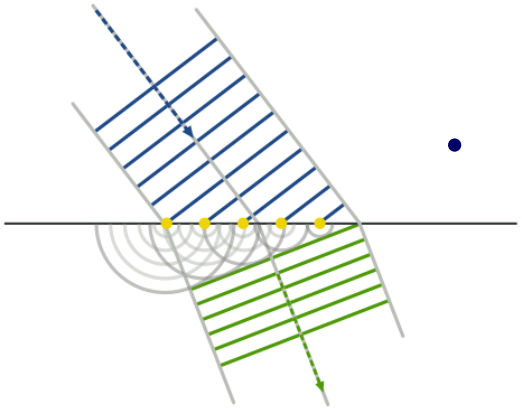


Measurements

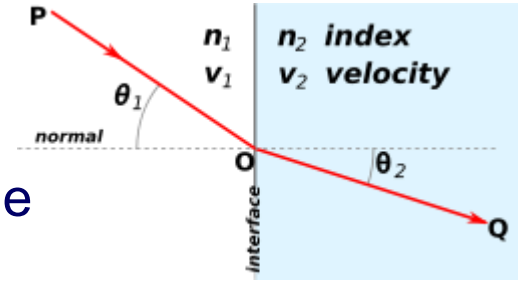
- Adrok Scanner measures:
  - **Dielectric Permittivity**
    (provides rock type & fluid content AND depths)
  - **Resonant behaviours of molecules**
    (which highlights changes in rock horizons)
  - **Basic facts of spectroscopy**
    (which classifies lithology)

Physics

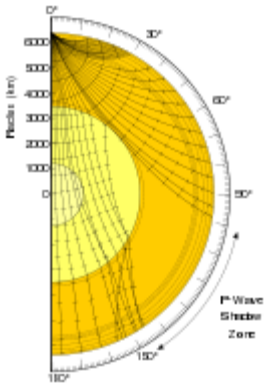
- Adrok Scanner uses and conforms to, *inter alia*:
  - Maxwell's Equations of electromagnetic propagation of light based on the laws of Gauss, Ampere & Faraday



  - Huygen's principal of wave front diffraction



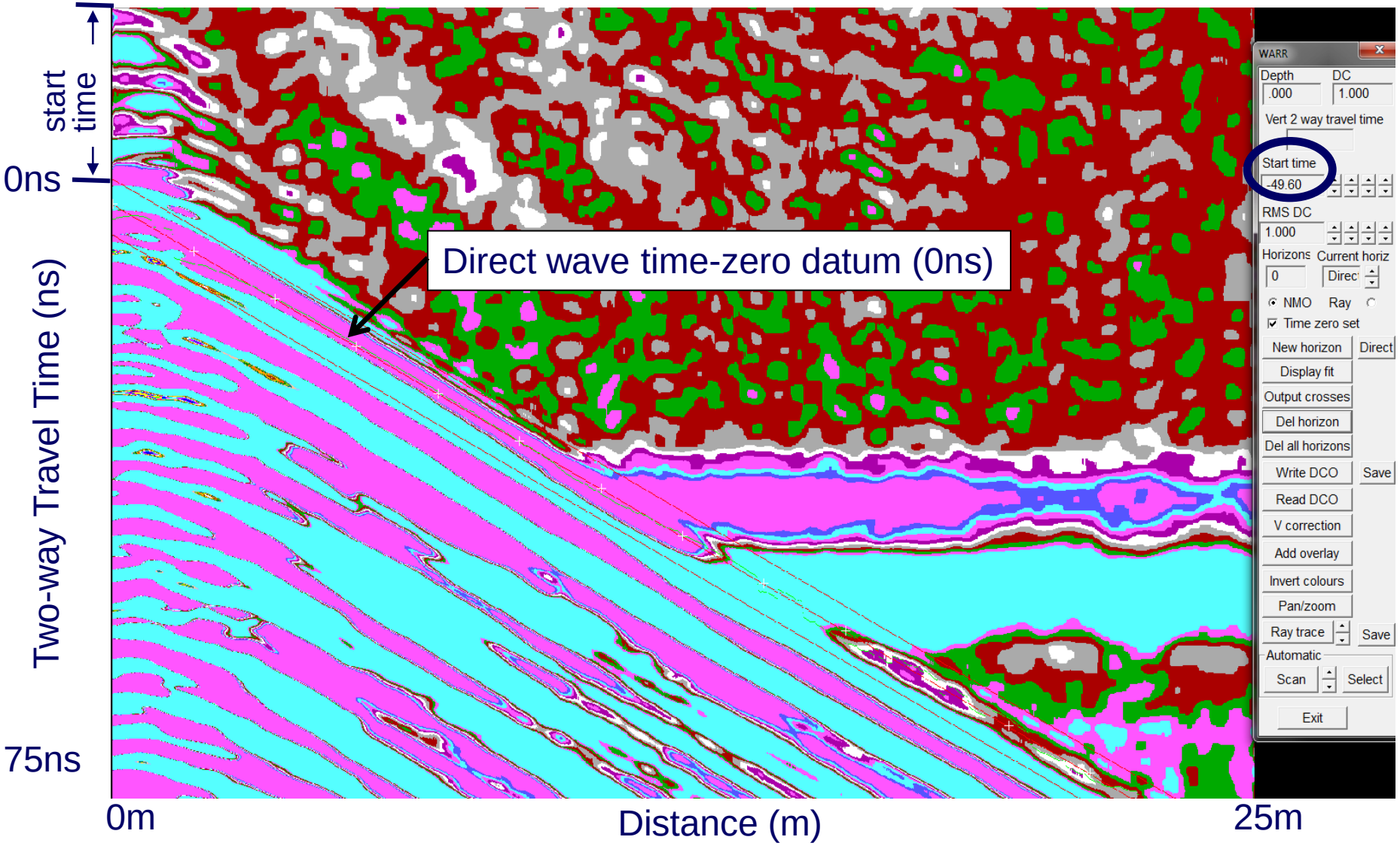
  - Fermat's principal of least time



  - Snell's Laws as required by Ray Tracing theory

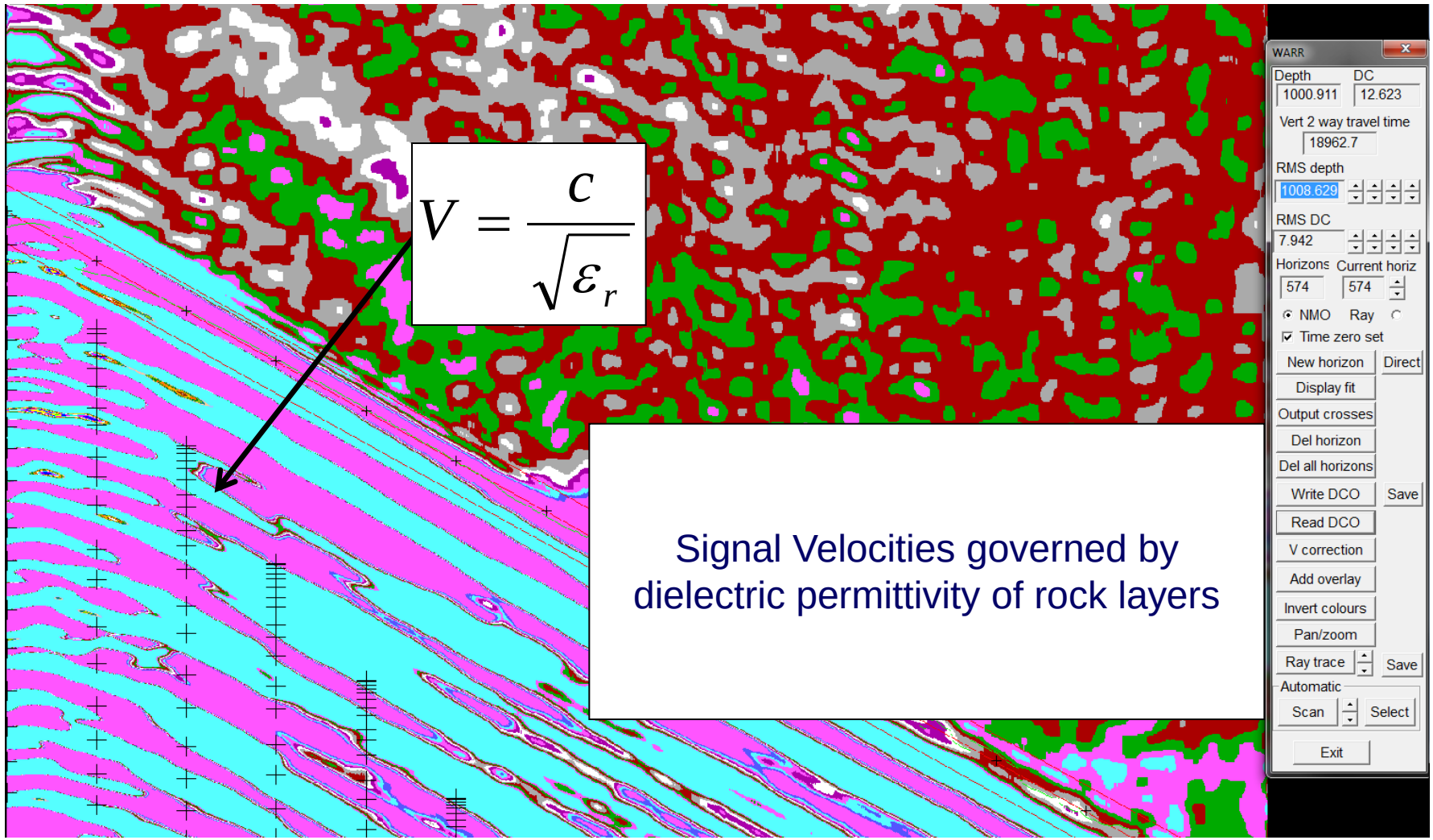
Depthing (time conversion)

Step 1 in depth processing: Time Zero & First Horizon



Depthing with Dielectrics

Subsequent horizons picked



0ns

Two-way Travel Time (ns)

75ns

0m

Distance (m)

25m

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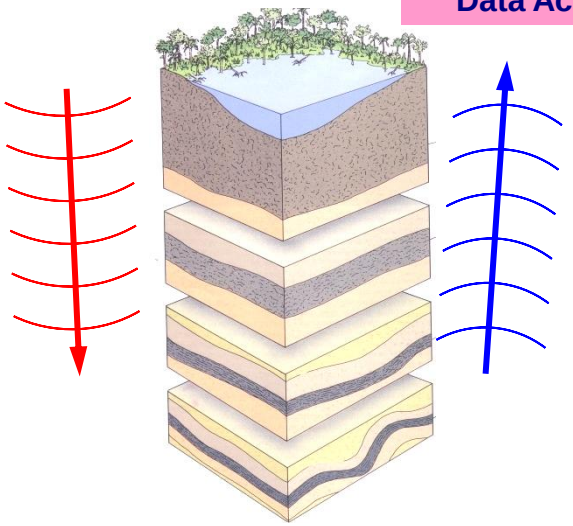
Adrok Survey Process

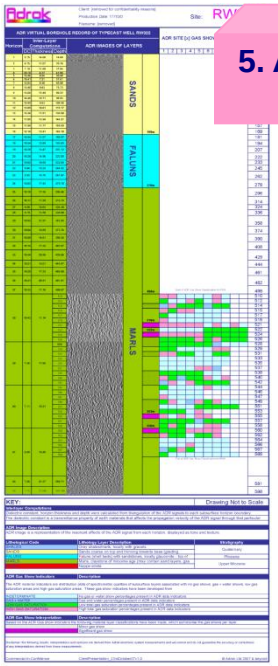
1. Pre-survey field modeling

2. Training for geological signatures

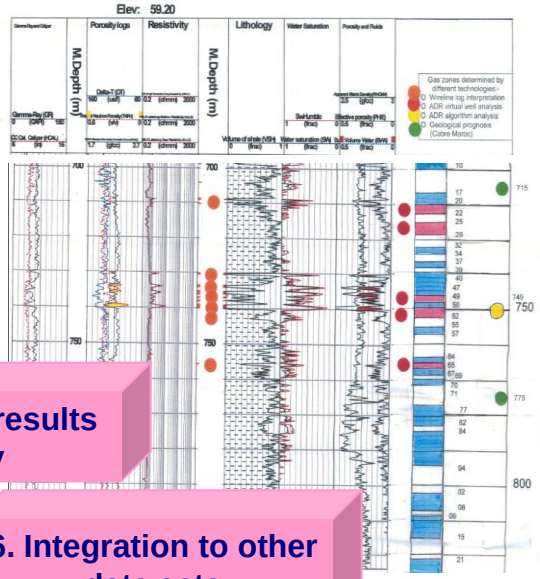
3. On-site Survey Data Acquisition



4. Data Processing & Interpretation



5. Analysis & results Delivery



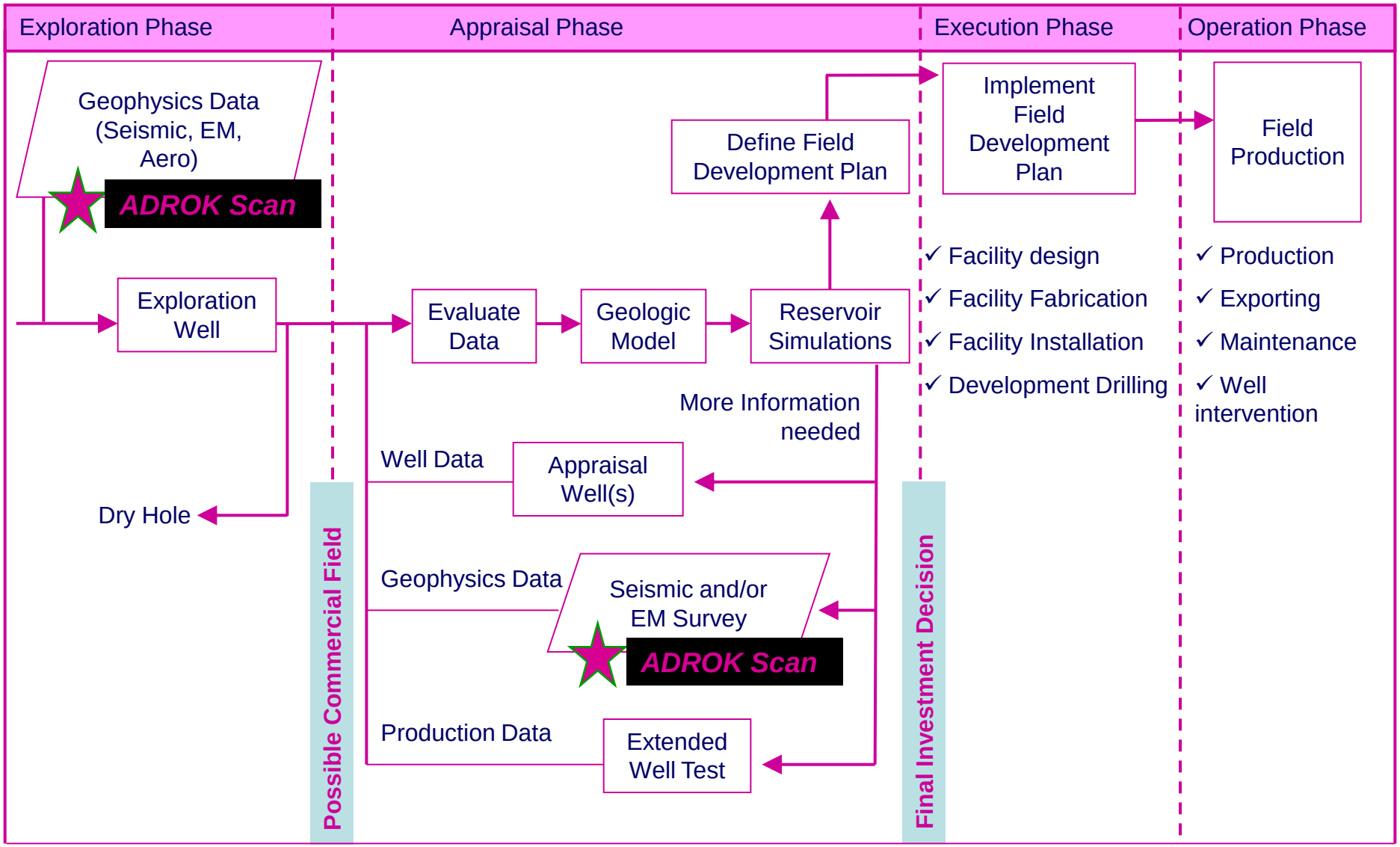
6. Integration to other data sets

THE BRITISH ASSESSMENT BUREAU
ISO9001
UKAS MANAGEMENT SYSTEMS
4307

Certification No.188208

Adrok aims to provide useful subsurface measurements to help de-risk drilling programmes...
thus enhancing hydrocarbon recovery!

Adrok's fit with Oil Company's Workflows



Technology Summary

- Adrok's technology provides:

1. Stratigraphy (like seismic)
2. Detailed information on rock characteristics (like well logs)
3. Actual rock petrography (like cores)

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Case Studies – field proof

(1) Onshore Oklahoma Oil field survey for U.S. Independent

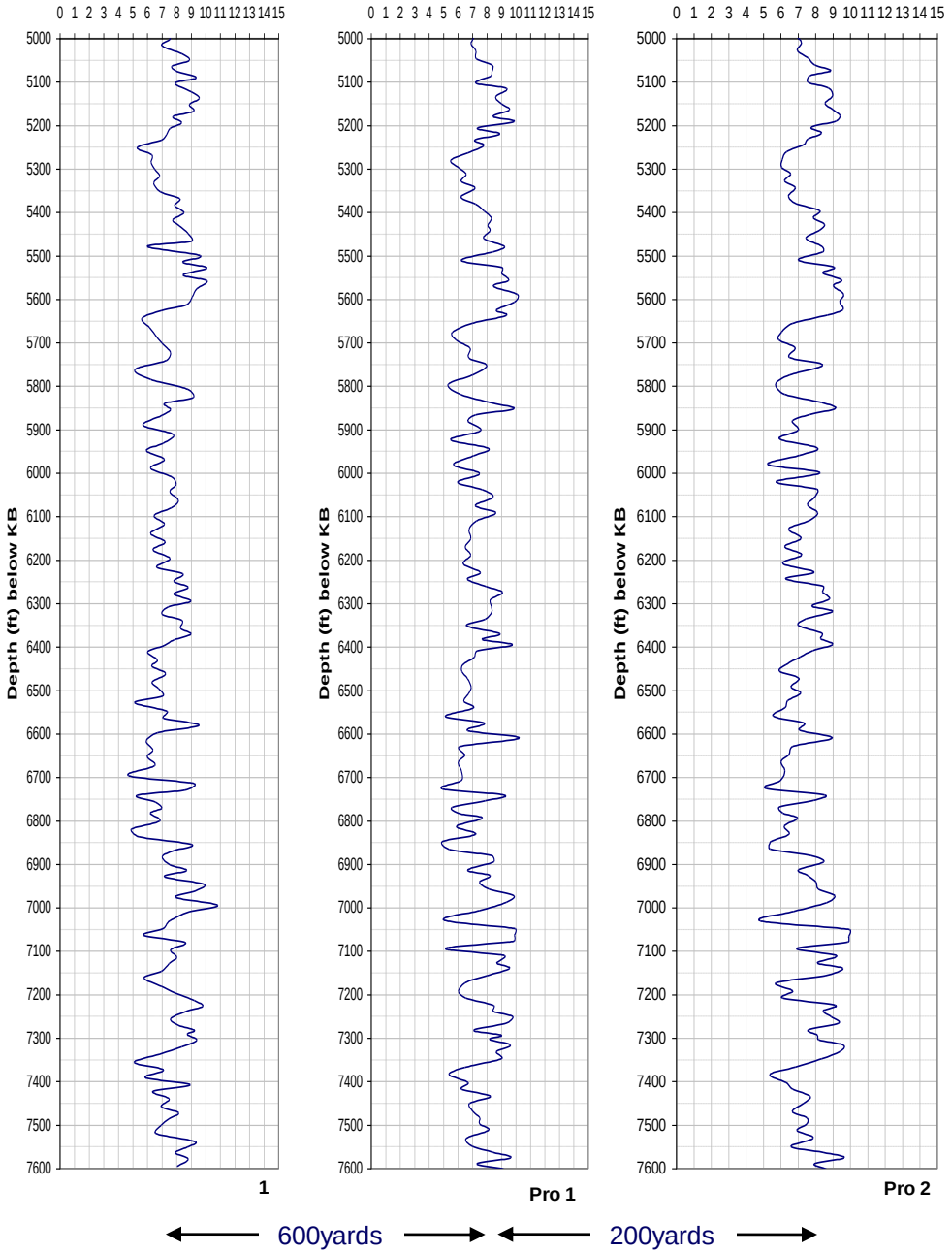
Onshore USA, Oklahoma

Onshore USA, Oklahoma

- Survey of an onshore basin located in Oklahoma, USA
- Surface terrain comprised low lying farmland
- Adrok trained on 1 drilled well location (for oil, gas & sedimentary rock layer signatures) in basin
- Adrok did not train or typecast on any cored rock samples
- Adrok processed and predicted the virtual borehole log (before spudding commenced)
- Client's needs were for Adrok to prognose tops of Wilcox rock
- Depth of ADR penetration was over 7500ft
- Prospect site was approximately 1km offset from training well location
- The results of the Adrok survey were compared to the actual drilling results
- No HSE accidents

Initial Well

Adrok's Prognosis in March 2010 (before client's drilling)

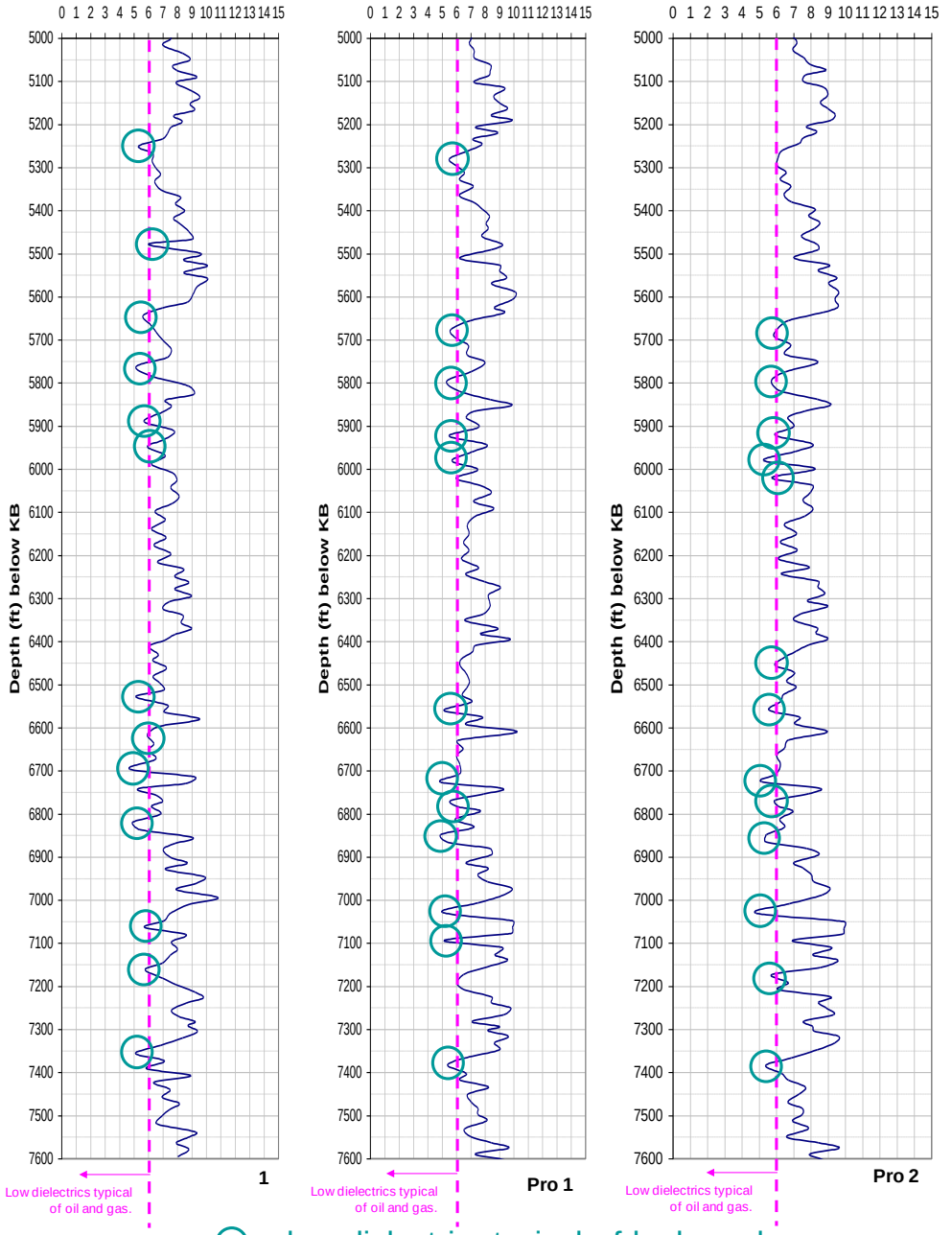


Dielectric Constant Logs (5000-7600ft KB)

PETEX 2010

Initial Well

Adrok's Prognosis in March 2010 (before client's drilling)



◯ = low dielectric, typical of hydrocarbon

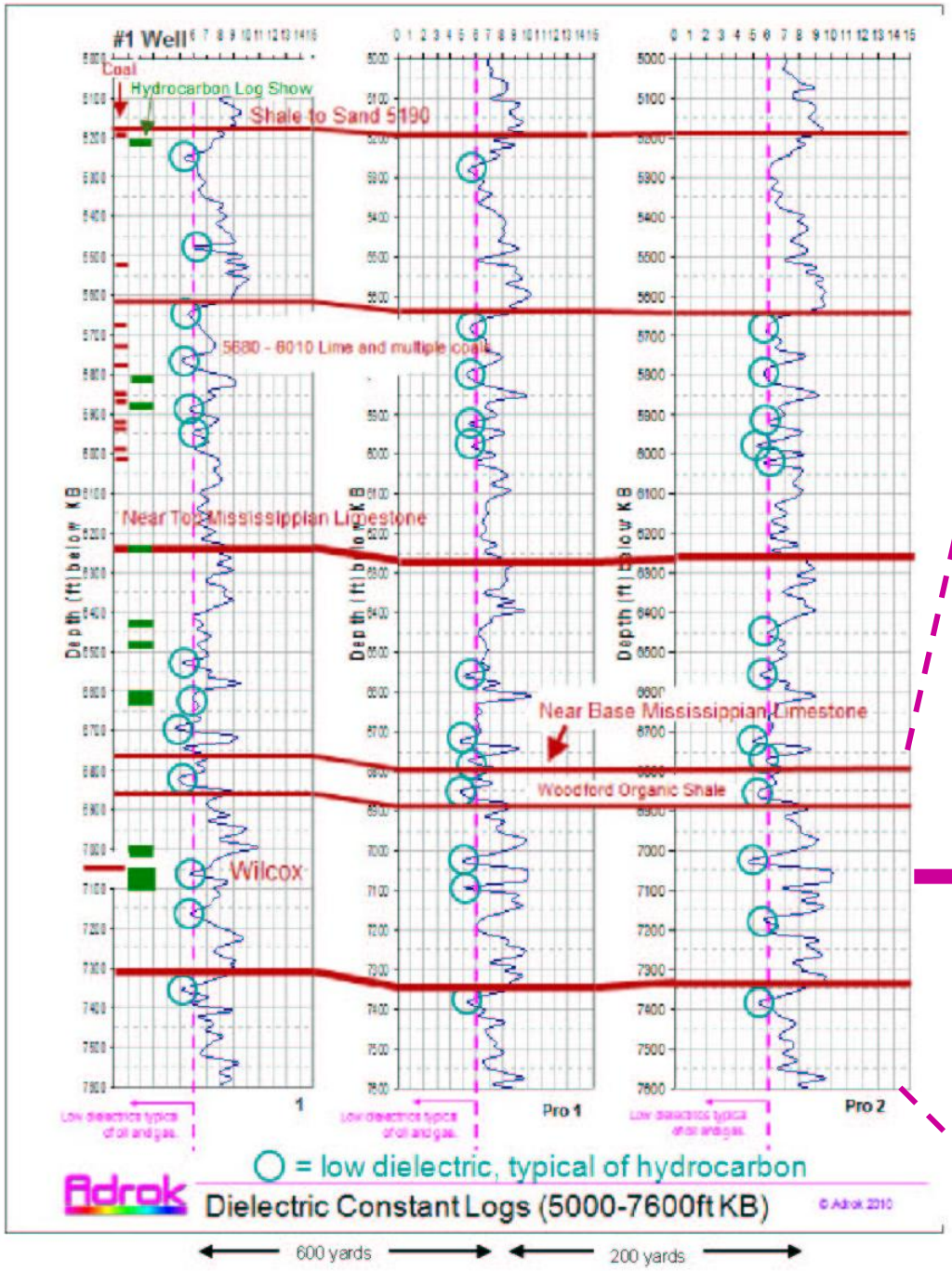
Dielectric Constant Logs (5000-7600ft KB)

PETEX 2010

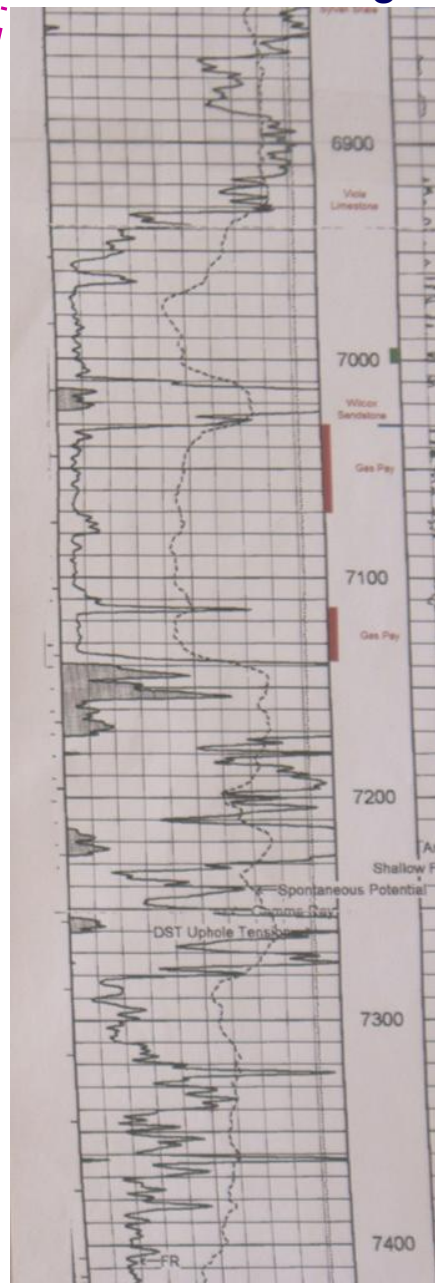
Adrok

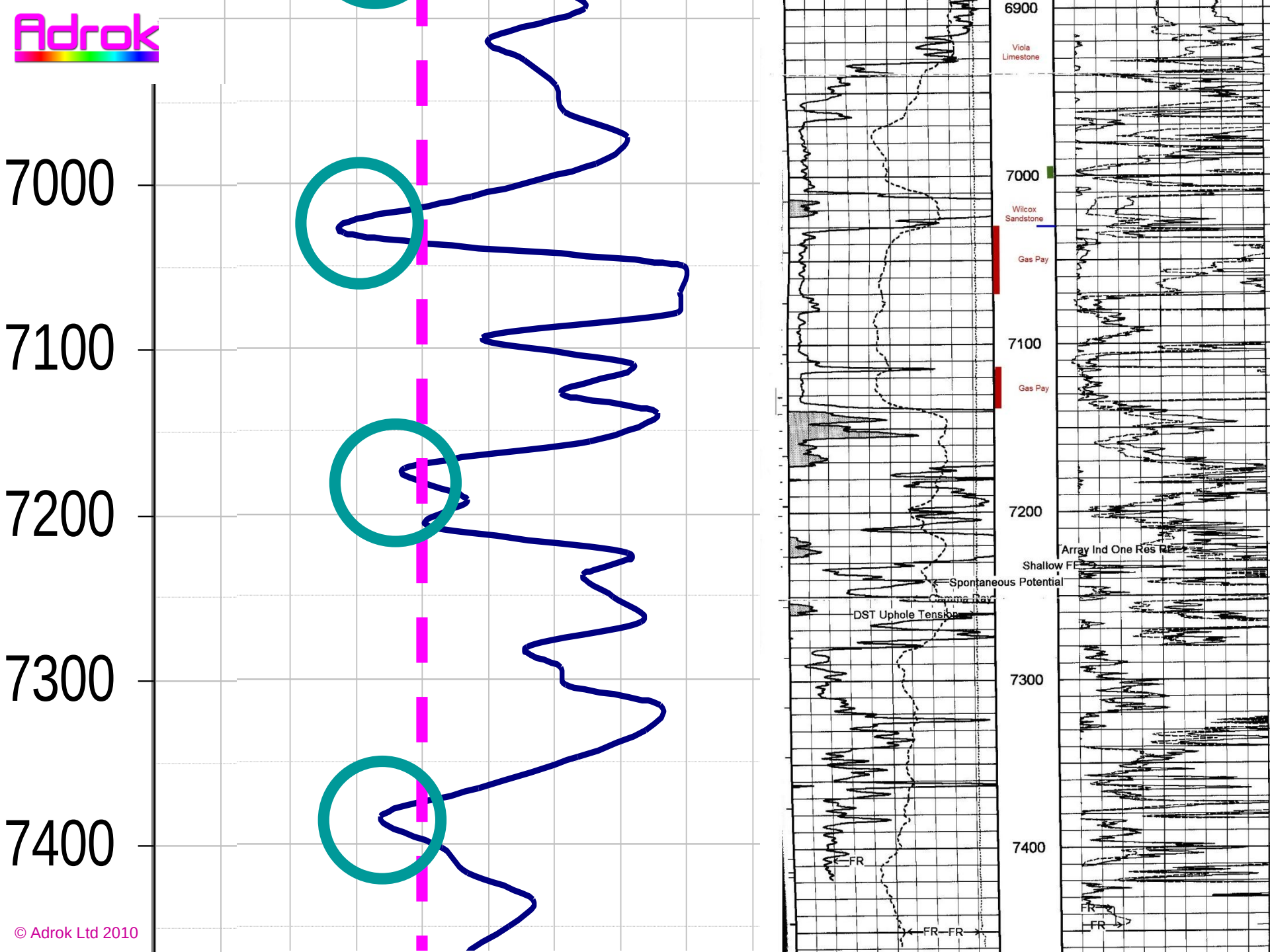
Initial Well

Adrok's Prognosis in March 2010 (before client's drilling)



Client's drilled log




Adrok
7000
7100
7200
7300
7400
6900
Viola Limestone
7000
Wilcox Sandstone
Gas Pay
7100
Gas Pay
7200
Array Ind One Res RF
Shallow FF
Spontaneous Potential
Gamma Ray
DST Uphole Tension
7300
7400
FR
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Onshore USA, Oklahoma

Conclusions:

- Drilling and testing has confirmed Adrok's predictions.

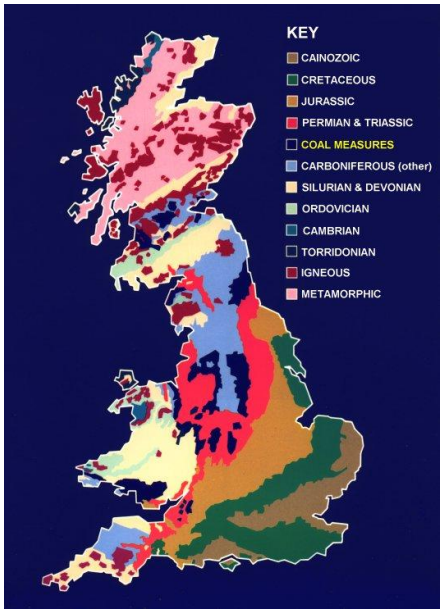
ADR Prediction		Driller's Log	
Depth to top of hydrocarbons	Thickness	Depth to top of hydrocarbons	Thickness
7008.5 ft	21.9 ft	7030 ft	42 ft

- Adrok's depth accuracy to oil & gas accumulation was 0.3%
- The initial well has now been completed and is producing:
  - 1,400,000 cubic feet of gas per day
  - 22 barrels of oil per day

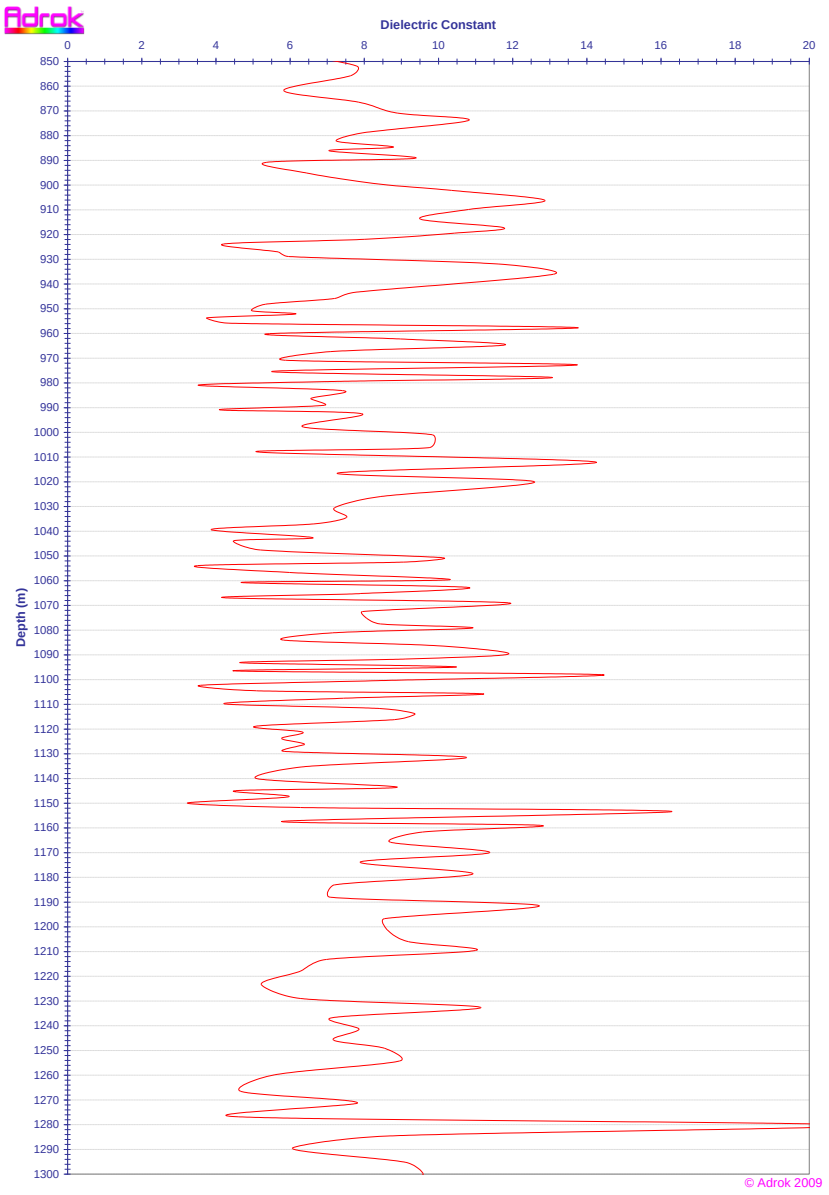
(2) Onshore UK Coal Bed Methane field trial with

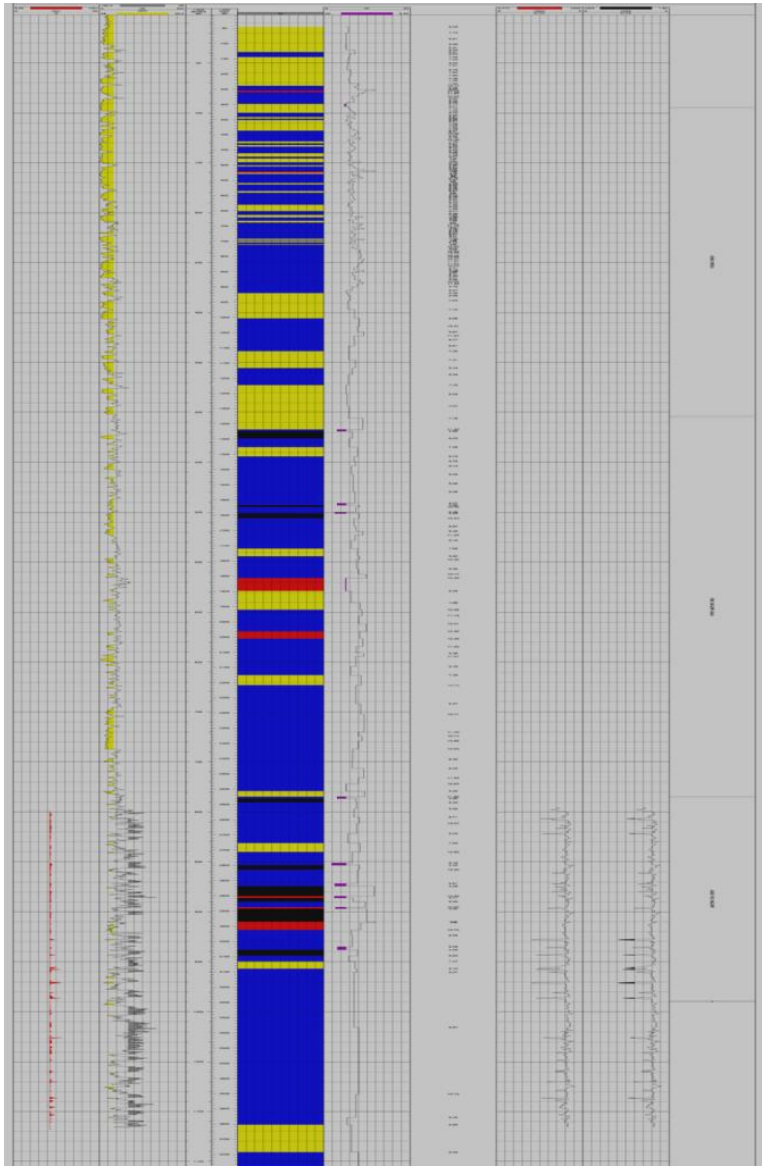
Case History: Onshore UK, coal bed methane

- Working with BG Group to develop a reliable coal bed methane exploration and appraisal survey tool based on Adrok's technology
- Survey Area located onshore United Kingdom
- Adrok trained on 4 drilled well locations (for coal signatures and for sedimentary rock & Igneous rock layer signatures)
- Surface terrain comprised low lying farmland. Survey sites on pads.
- Carboniferous marine sequences
- BG Group is interested in dielectrics as a new measurement to help their subsurface interpretations for tracking coal beds
- The results of the Adrok survey were compared to the actual drilling results (Adrok presented results before drilling commenced).
- Adrok produced Virtual borehole log charts
- No HSE accidents



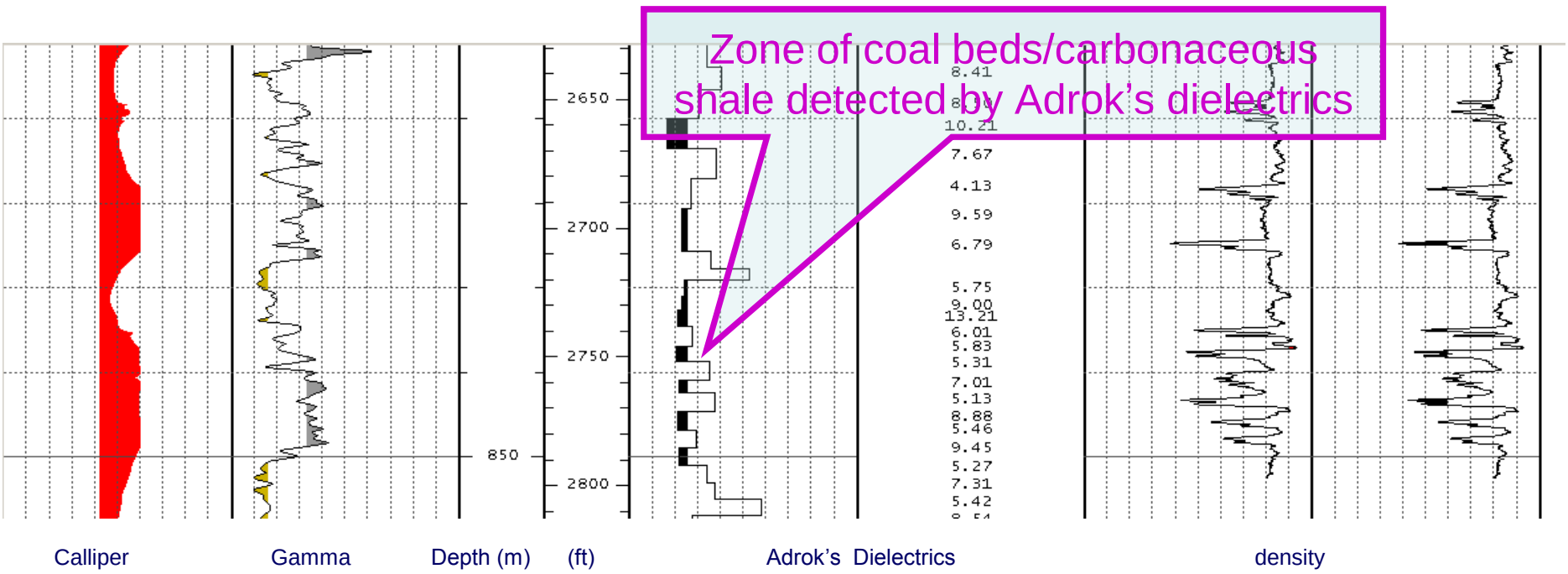
Adrok's Dielectric Profiles at Well-sites





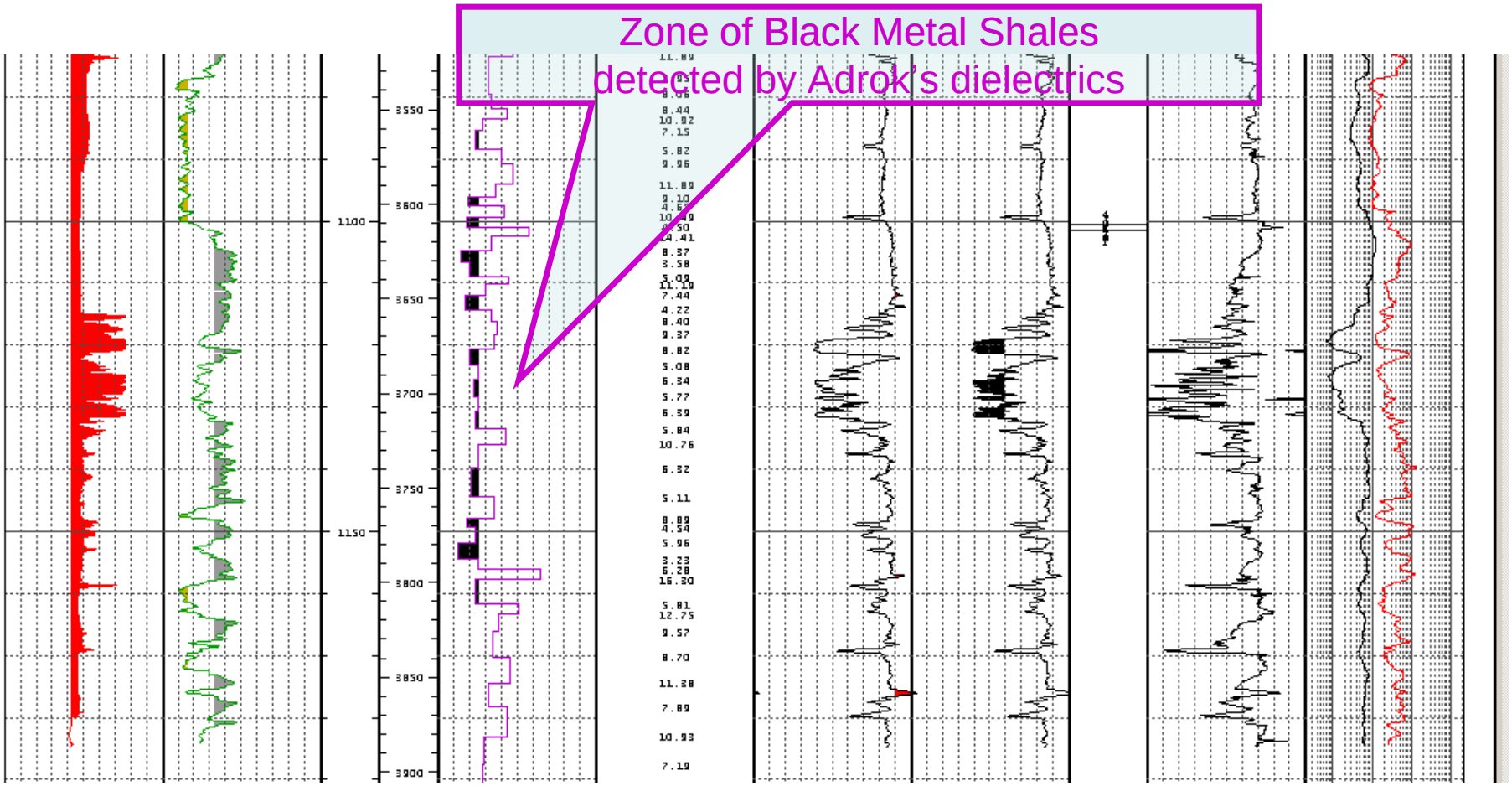
PETEX 2010

Blind Test – Limestone Coals



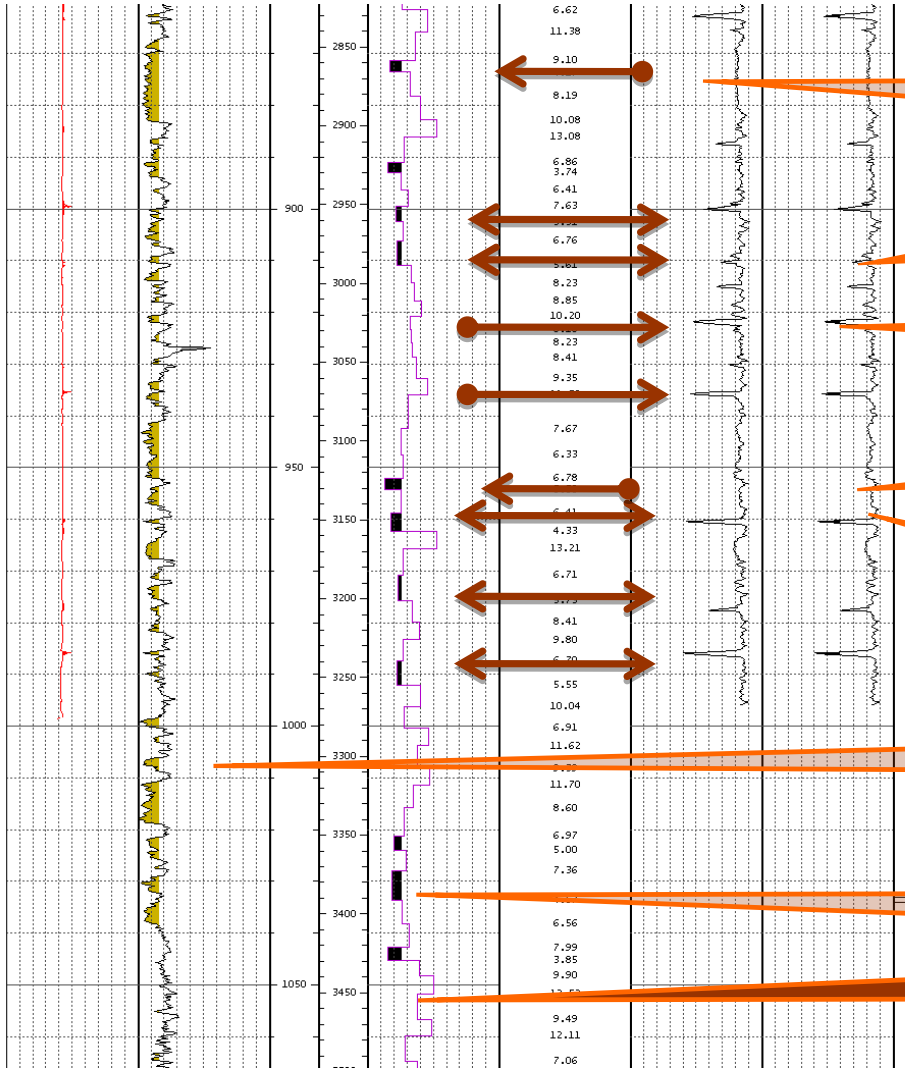
Courtesy of BG Group

Calibration Well - Black Metal Shales



Courtesy of BG Group

Blind Test Well



Sandy section – low DC?

Coal picked OK

High DC - Wet coal beds?

Shale bed looks like a coal?

Coal picked OK

Bannockburn Coals – Wet?

Knott Coal

Black Metals Shale

Calliper Gamma Depth (m) (ft) Adrok's Dielectrics Density

Courtesy of BG Group

Client's Conclusions – Dielectric Profiles at Well-sites

- What is being measured?
  - Adrok Dielectric responses
    - Coal has low dielectric < 3
    - Water has high dielectric 80-81
    - Calcite has high dielectric 8
- Depth control
  - seems good +/- 10 feet
- Coal beds
  - prediction is possible but not reliable
  - high dielectric – water filled?
  - low dielectric- tight? gassy?
- Sand beds
  - low dielectric – sands with hydrocarbon?
  - high dielectric- calcite cemented?
- Volcanics
  - High dielectric suggesting its presence at a particular depth
- Shale Gas beds
  - Low dielectric suggests there is organic material in the Black Metal Shales

Way Forward in CBM

- What benefit does the Adrok tool provide to coal bed methane exploration?
  - Answer:
    - Track coal beds
    - Maps water content
    - Accurate depth control +/- 10feet
- Next stage is to use ADR's spectral analysis to ascertain coal quality & improve reliability
  - "good" coals versus wet coals

Summary

Summary & Conclusions

- **Adrok ADR Scanner**
  - Field proven innovative geophysical system
  - Based on strong sets of scientific procedures
  - Helps map, locate & identify oil, gas, water & minerals from the surface with precision & confidence

  … therefore helps reduce drilling dry holes

- **Adrok Survey Services**

  – onshore & offshore Virtual Borehole logs
  - Appraisal
  - Exploration
  - Field delineation
  - Gross volumetrics
  - Infill drilling – location, identification and confirmation
  - 2D structural surveying

Acknowledgements

Adrok wish to thank Professor John McManus for his independent evaluation and objectivity on the application of our technology.

Also, we wish to thank all of the Oil & Gas Clients for:

- providing us with the opportunity to explore their sites
- for spending their invaluable time with us testing and learning about our technology and its potential benefits to oilfield project derisking.
- In particular,

BG GROUP

CAITHNESS PETROLEUM

Thank You

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