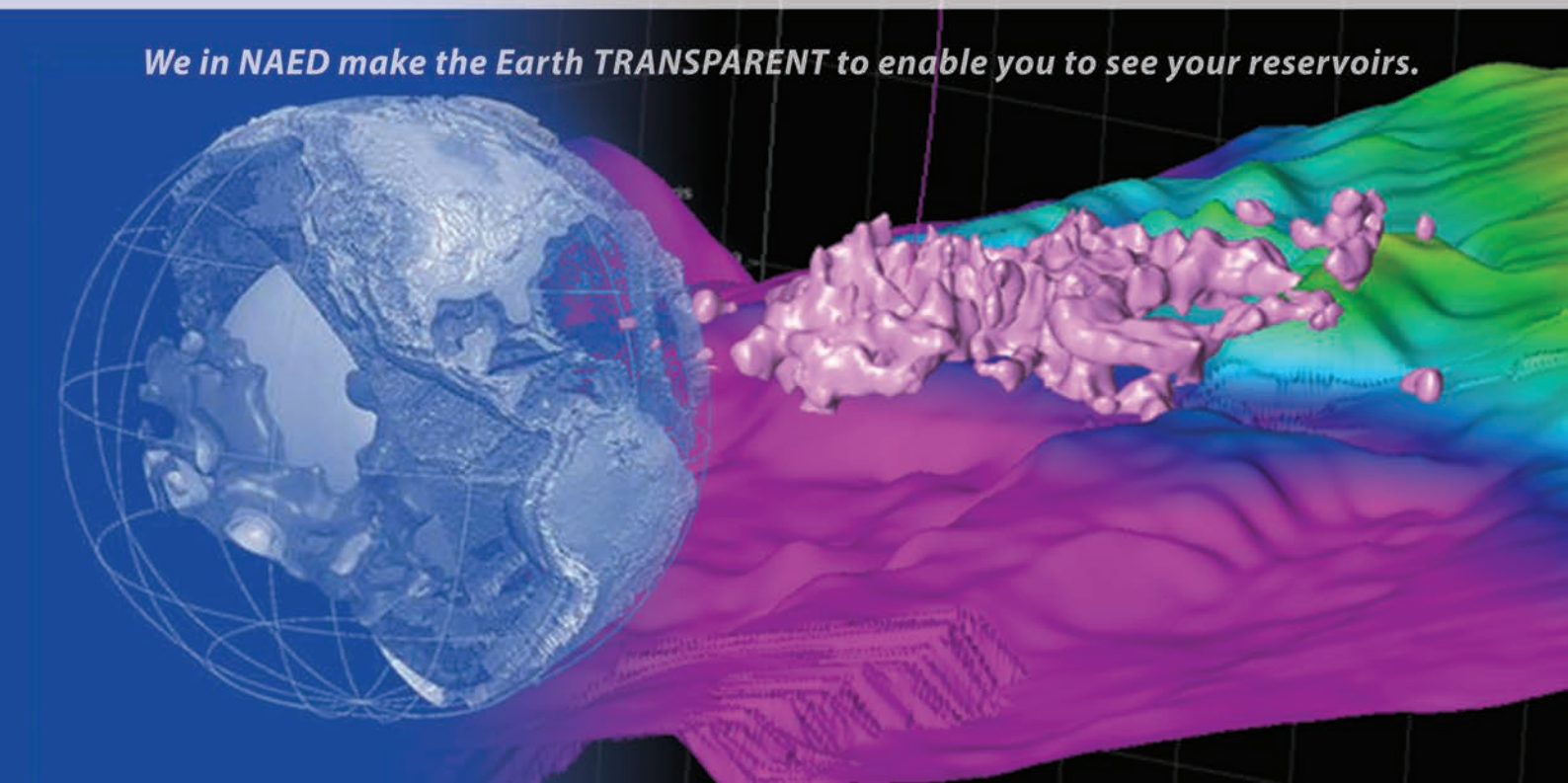
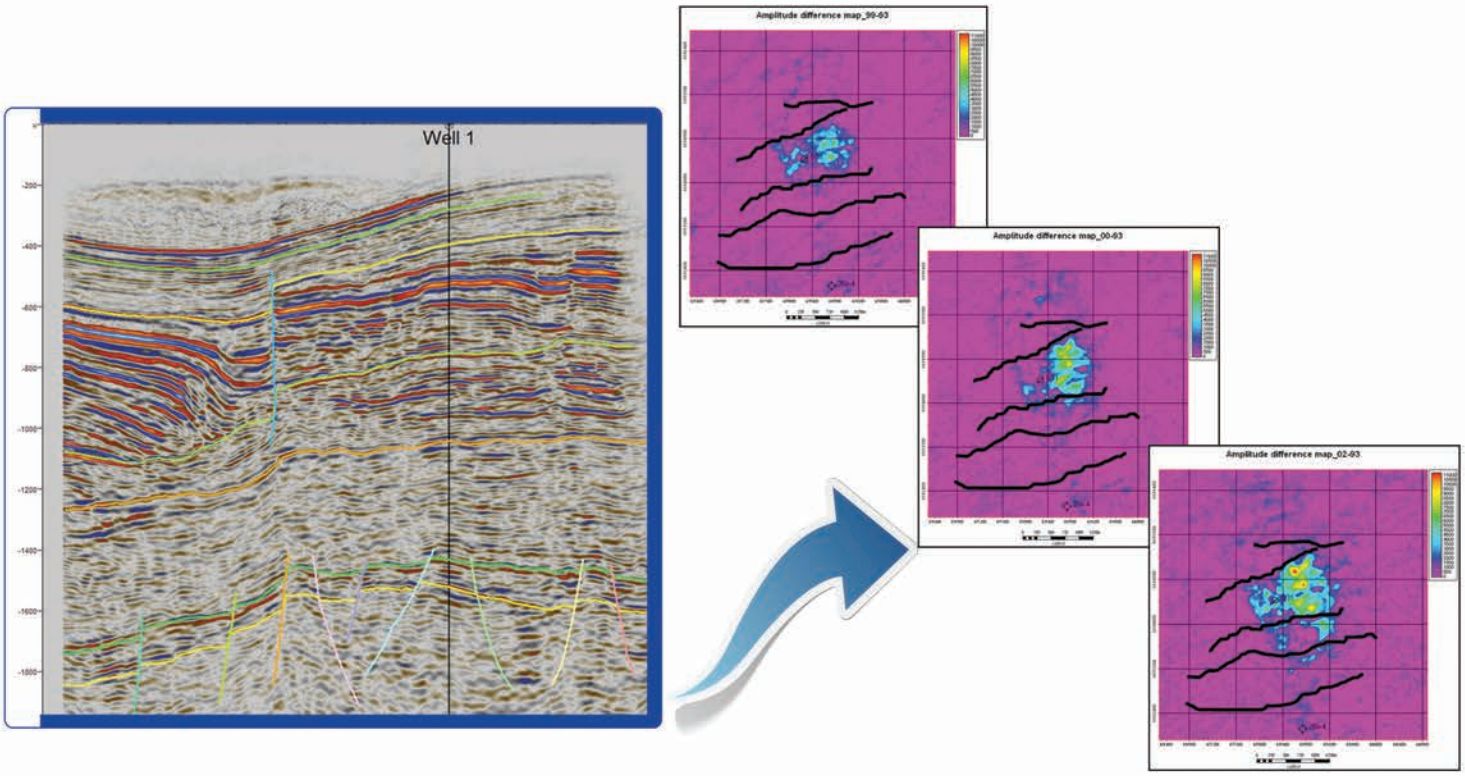
NARGAN-AMITIS
Energy Development

SEISMIC QUANTITATIVE INTERPRETATION & RESERVOIR CHARACTERIZATION

You may use your seismic data to pick the horizons and faults to recognise the structure of your reservoir, but question is that is that all? You spend millions of dollars to acquire the seismic and process it. Can we boost the interpretation and extract as much as information we can? Can we characterise our reservoir in more detail, and how? This is where NAED Quantitative Interpretation tries to reach at.



Our **"quantitative seismic solutions"** correlates seismic data with well data, carries out advanced Rock Physics and run seismic inversion techniques to extract the useful information about the reservoir quality. Apart from having an exploration view, and supporting reservoir modelling, the output of these analysis in conjunction with geological studies would assist the well planning department to find the optimum well locations and monitor drilling the well.



NAED QUANTITATIVE SEISMIC INTERPRETATION SERVICES

Seismic Basic Quantitative Interpretation:

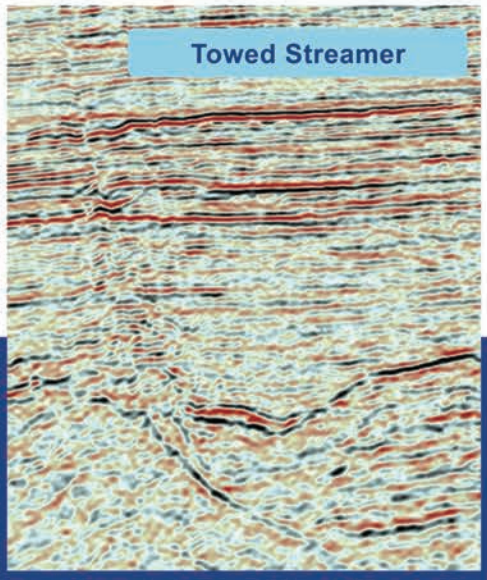
- Review and asses the available seismic data
- Propose new processing and acquisition program considering time and budget available
- Rock Physics Analysis
- Well tie analysis and AVO modeling
- Seismic inversion
- Forward modeling
- Velocity modeling and depth conversion

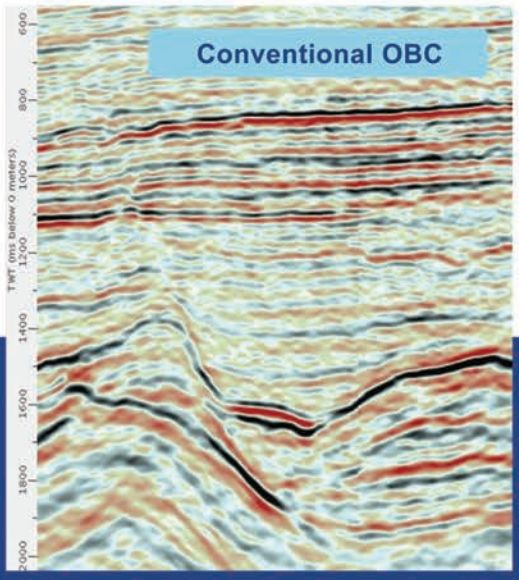
Seismic Advanced Quantitative Interpretation:

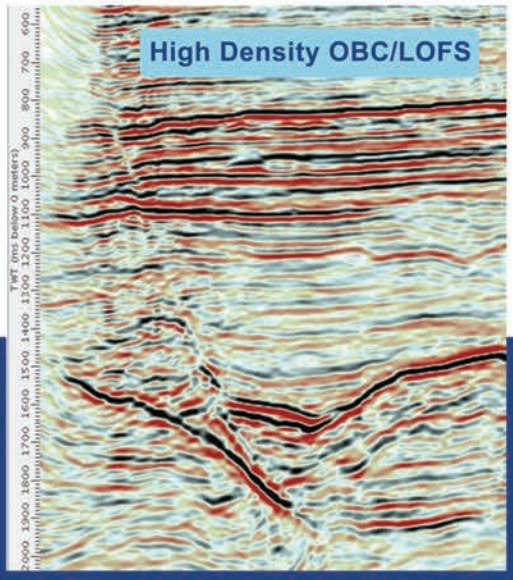
- Seismic reservoir characterization
- Net pay estimation
- Facies recognition and fracture orientation/concentration in three dimension
- 4D seismic studies
- Prepare well prognoses
- Monitor drilling the well and update the deviation survey on real time

Review and asses the available seismic data (seismic data initialisation):

Not necessarily all the seismic data are ready for the quantitative seismic interpretation. Some can be fixed by the light post stack processing. This is where we try our best to make the available seismic data for fit to purpose. Sometimes we need to re-process the seismic data, but in more AVO friendly way. This is where we propose seismic processing algorithms. It is sometime worth to think about acquiring another seismic data.





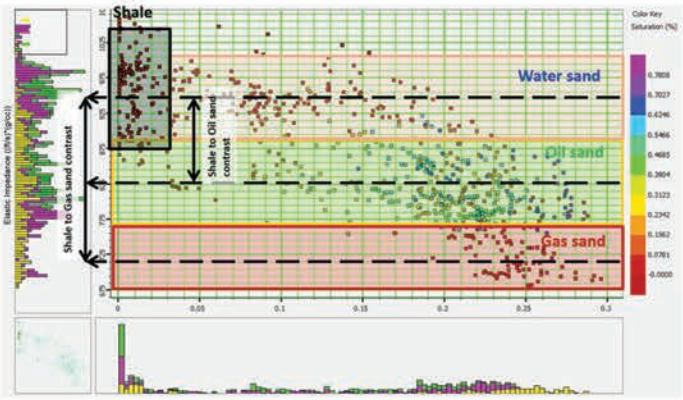


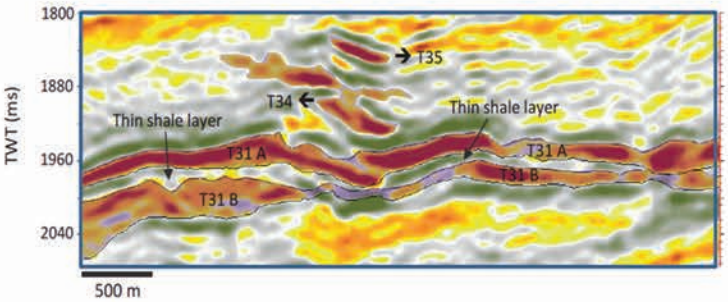
Rock and fluids physics and AVO modelling:

What is the language of the seismic? Rock and fluid physics translate back the seismic in more understandable way in terms of the reservoir quality. Rock and Fluid physics reveals the effect of reservoir thickness, porosity, NTG, saturation and other parameters on the seismic response. In addition, we do carry out the advanced AVO modelling to realise the effect of reservoir properties on different angles of the seismic data. This is the key point to select the optimum seismic data for different purposes. ***We believe seismic is full of information, we just need to listen at it, using its own language.***

Seismic inversion:

This is the key step to translate back seismic data from some wiggles to more understandable acoustic properties that are directly connected to the reservoir properties. With thank to our advanced Rock Physics and AVO modelling, we run the seismic inversion. NAED's feasibility study would assist us to select the best inversion method. We have the ability to run the pre-stack and post-stack seismic inversion methods from relative to absolute impedance. Some of our key seismic inversion algorithms are Coloured Inversion, Elastic Impedance, Extended Elastic Impedance and Simultaneous Seismic Inversion.



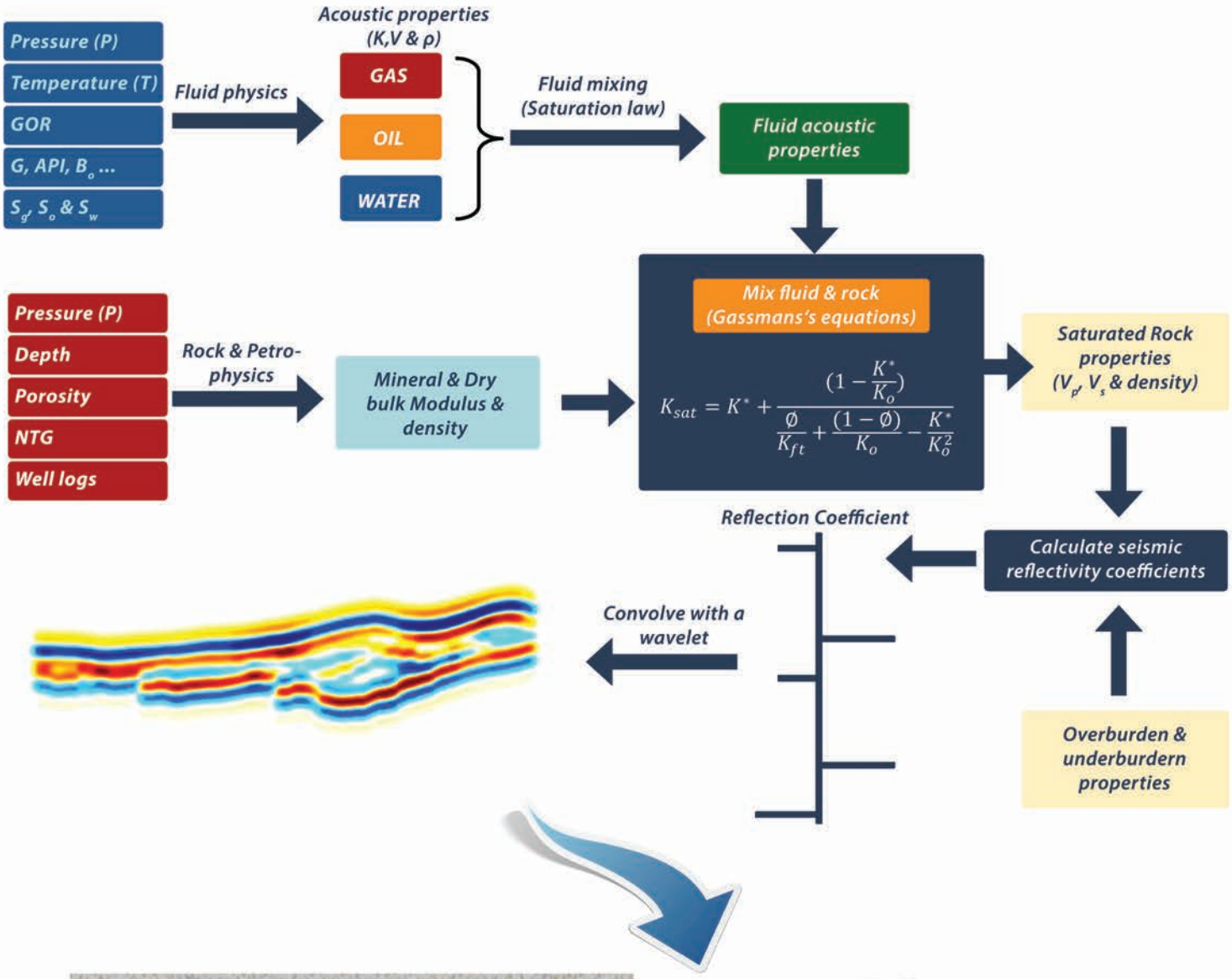


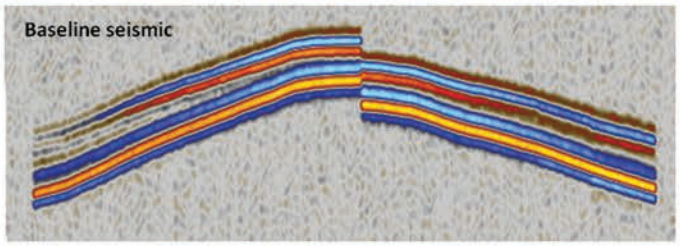
NAED Seismic Quantitative Interpretation

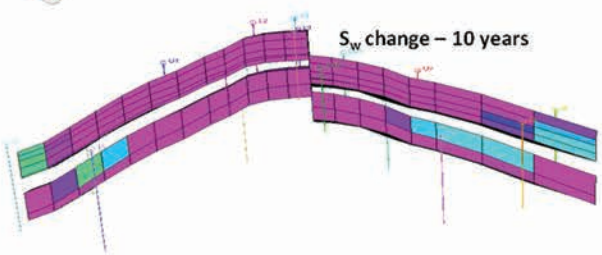
is aiming to put the light into your reservoir.

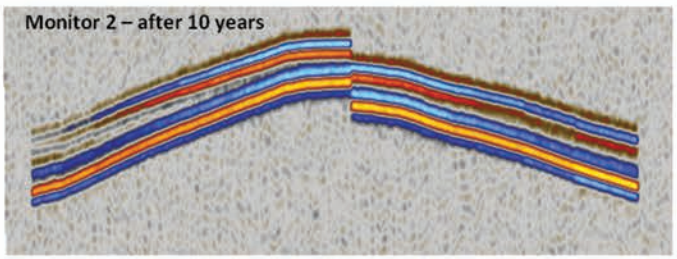
Forward modelling to understand the seismic in terms of reservoir language:

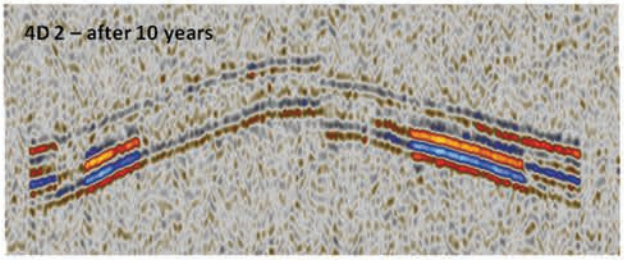
For understanding the effect of reservoir parameters (such as thickness, porosity, NTG and saturation) on the seismic signal, we have designed our own flowchart on the forward modelling to produce synthetic seismic signal on 1D, 2D, 3D and 4D. This would assist us to interpret 3D and 4D seismic data in more accurate and quantitative way. In addition, this is a powerful tool and quite new idea to QC the reservoir model on the seismic domain. We should be able to produce 3 dimensional synthetic seismic from our reservoir model in different times from exploration to reservoir monitoring that looks reasonably similar to the observed seismic. Any discrepancy would highlight the parts of reservoir model that needs for further updates.





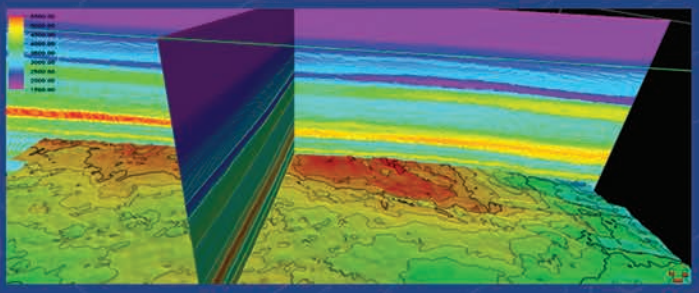






Velocity modelling and depth conversion:

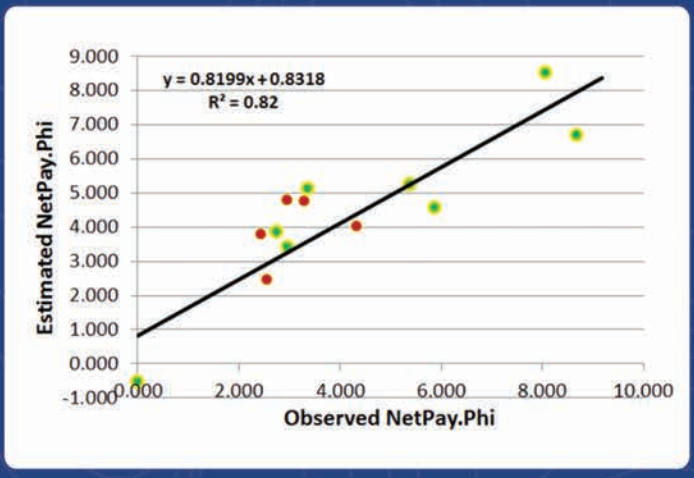
We believe that an accurate time to depth conversion is the key point for a proper volumetric estimation and the reservoir modelling. Utilising variety of methods, we do optimisation to select the best velocity modelling for each interval with sharp velocity breaks. We test different methods from V0+K to seismic stacking velocity.



We in NAED make the Earth TRANSPARENT to enable you to see your reservoirs.

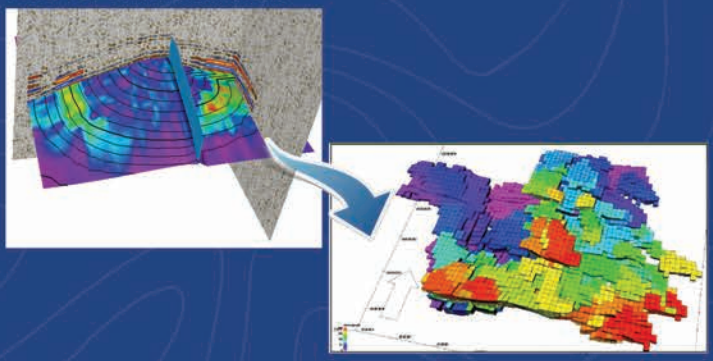
Net pay estimation:

Our advanced Rock Physics and AVO modelling teaches us to extract the reservoir net pay from the seismic data. We do it either with relative or absolute seismic inversion with band limited algorithm, or even simultaneous seismic inversion. We have developed an internal algorithm that properly works on the thin reservoirs, too. This is a vital information that is essential to have for the well planning during exploration, appraisal and development phases. Nowadays, it is extensively used to drill the deviated well.



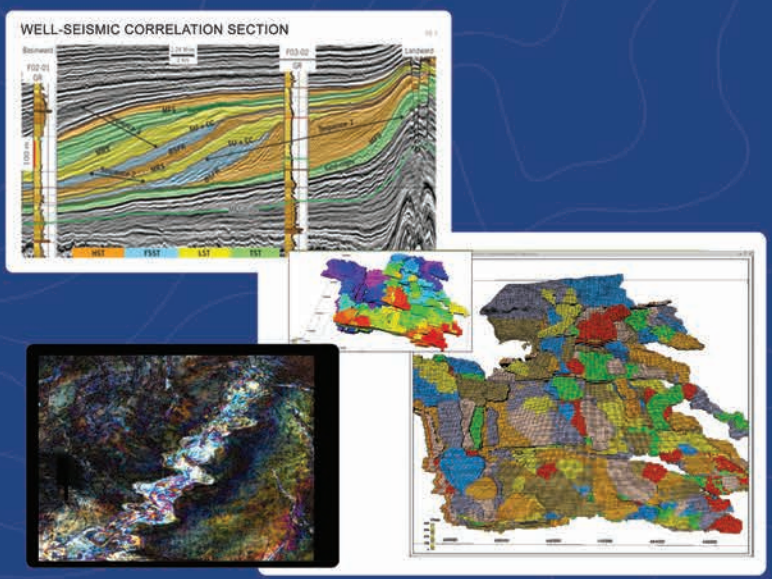
Seismic reservoir characterization:

Although the seismic vertical resolution is not as good as well logs, but it covers the reservoir in 3 dimension. Seismic is the only available and real measurements between the wells, thus why not to use it for the reservoir characterisation. Employing advanced Rock Physics, we understand the message of the seismic data, and consequently run the best inversion algorithms to drive the reservoir properties such as Porosity, NTG, Net Pay, Hydrocarbon Saturation and Fracture Orientation and intensity in 3 dimension. We should always bear in mind that not all the seismic data fits for this purpose, hence, a sensitivity and feasibility study is essential before any seismic inversion. This is what we would honestly tell to our clients whether or not stop the quantitative interpretation or carry out advanced reservoir characterization.



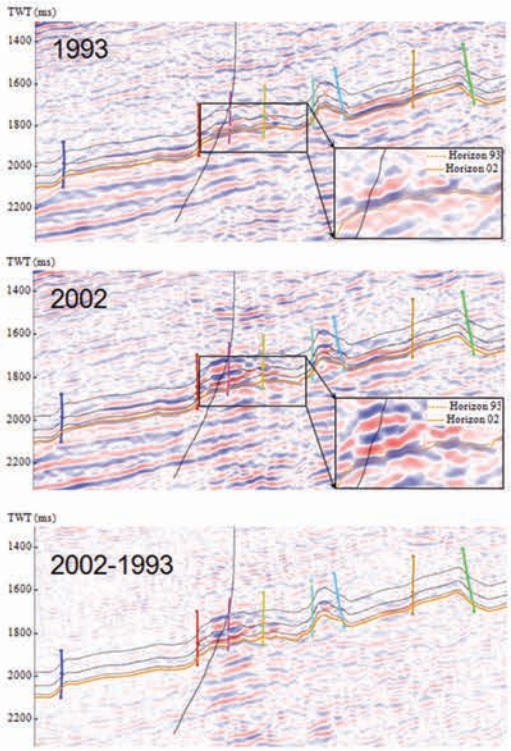
Facies recognition and fracture orientation/concentration in three dimension:

If the seismic data is available, why to only use the well data for the facies modelling and fracture analysis? One of the key points of seismic data is to recognise the sedimentary and stratigraphic environment, and thus, would be a powerful tool for the facies analysis. In case of having full azimuth seismic data, we extract the fracture orientation and intensity from your seismic data by Azimuthal AVO modelling. Employing our advanced geostatistics algorithms, we are able to integrate all available data including well logs, seismic extracted facies and fracture modelling and even core data in more scientific and practical way for this purpose.



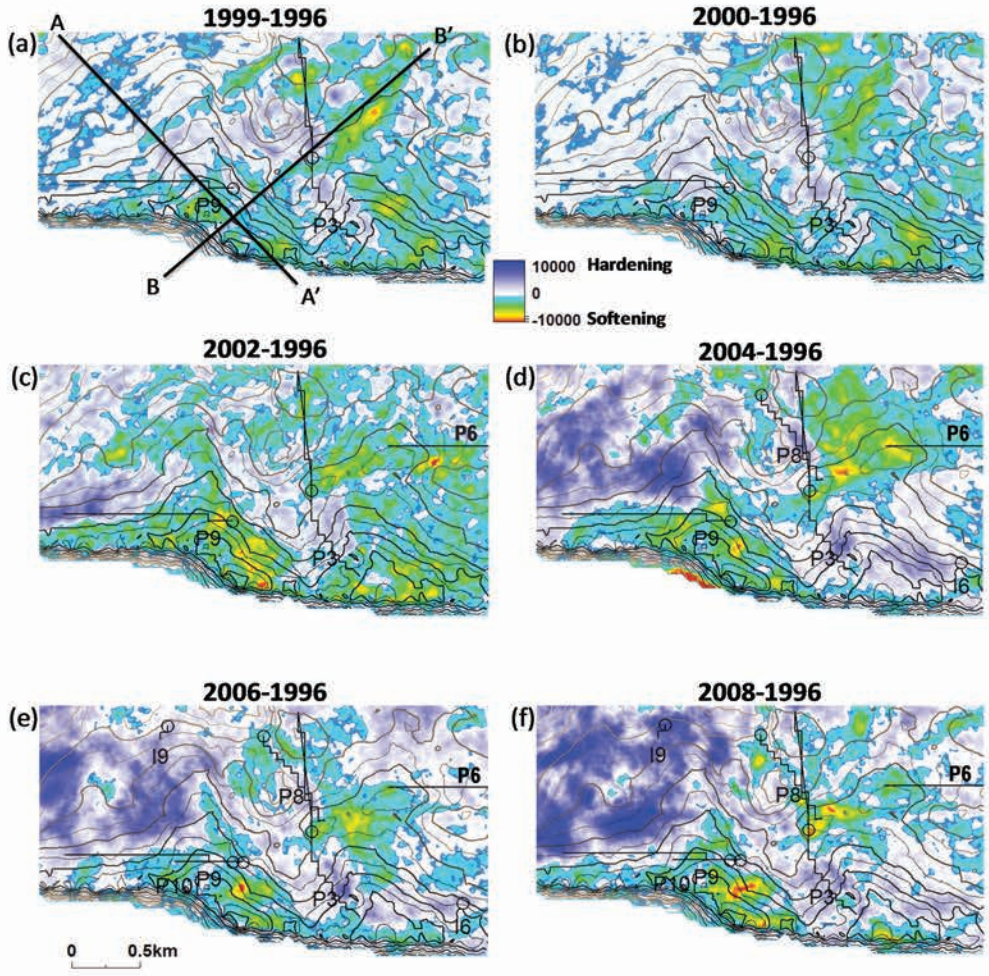
4D seismic capabilities:

4D seismic is a new technology that has been recently employed by major oil companies. This technology monitors and assists any EOR/IOR plan to improve the recovery factor, significantly. NAED covers almost every steps of 4D seismic studies, most of which are carried out by our own methods and tools.



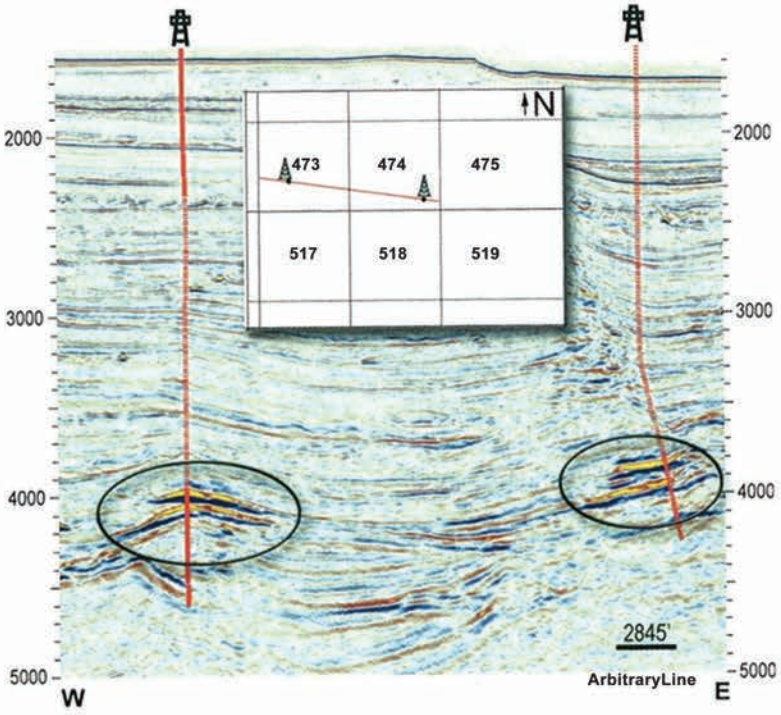
What we offer in the area of 4D seismic:

- **Early stage**
  - Feasibility study
  - Full simulation to seismic modelling
  - Field review for 4D seismic and cost estimation
  - 4D acquisition design
- **After Acquisition**
  - Post Stack 4D processing
  - Qualitative interpretation
  - Pressure and saturation change estimation using 4D data
  - New field development plans using 4D interpretations
  - Static and dynamic model updates using 4D/3D seismic data
  - 3D structural re-mapping using 4D seismic
  - Advanced volumetric calculation
  - Monitoring of water and gas injection using 4D seismic
  - Providing the optimised production and injection plan
  - Providing the optimised locations for drilling the production and injection wells



Well prognoses and monitoring the drilling a well:

We employ the seismic data to understand the reservoir in more detail. Thus, we are able to propose the optimised well location for any exploration, appraisal and development well. NAED, in addition, monitors drilling process and update the well deviation on real time.



OUR MAIN TOOLS

- **Petrel**
- **Kingdom**
- **Hampson-Russell**
- **SASJmp**
- **Velit**
- **Variety of In-house codes**

We are here to extract the quantitative and detail information from your seismic data.

NAED'S PARTNERSHIP

Nargan Amitis Energy Development Company is honoured to benefit from its international oil and gas companies, universities and research centres.

We believe that the advanced seismic quantitative interpretation and reservoir characterisation is not straightforward and each field has its own solution, hence our international partners can have added value in our advanced interpretation.

We in NAED make the Earth TRANSPARENT to enable you to see your reservoirs.

WE HAVE THE SOLUTION

www.naed.nargan.com

NARGAN AMITIS Energy Development | info@naed.nargan.com | +98 (21) 889 49 312