



# Microseismics for Petroleum

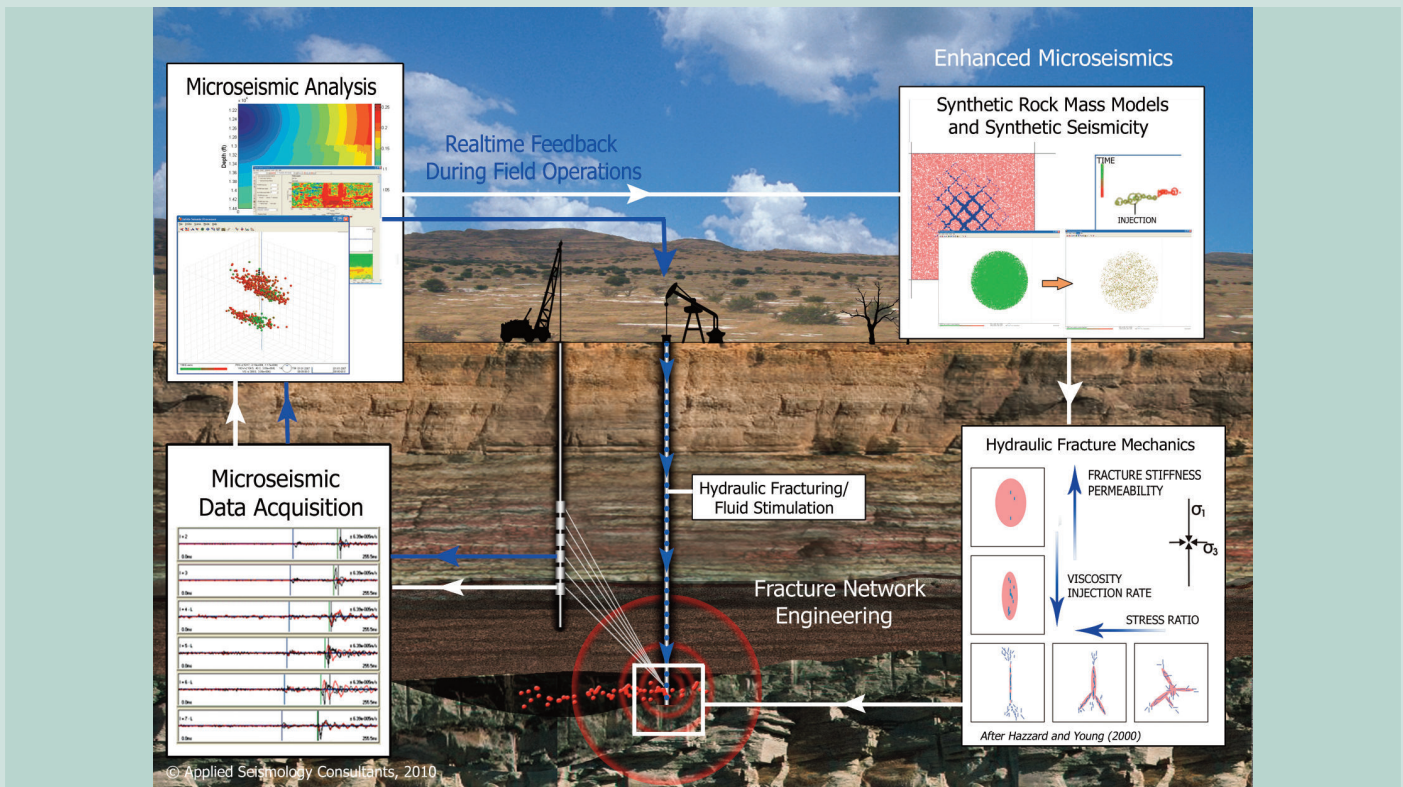
## Passive Imaging of Reservoir Development



Applied Seismology Consultants  
An Itasca International Company

**Microseismic monitoring, also known as “passive seismic”, allows engineers to visualise active fracture networks within developing or producing fields.**

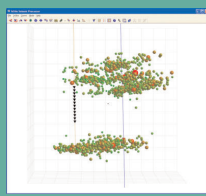
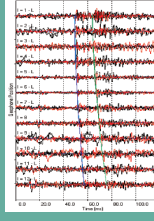
- Real-time optimisation of hydrofracture stimulations.
- Post-analysis of completion objectives and stimulation effectiveness with treated “hot zones”.
- Delineation of treatment breakthrough and communication with active fault structures.
- Mapping of extraction or injection paths through producing fields.
- Investigation of active fault zones, compaction and subsidence.
- Correlation with predictive numerical models for feedback on future site developments.



- Real-time processing of microseismic data can provide feed-back of information to engineers on the position, growth and effectiveness of a hydrofracture stimulation, or can map extraction and injection paths in a producing field.
- Post-processing yields a greater understanding of the treatment history and fluid migration. Analysis of microseismic parameters and clustering yields treatment hot zones and provides for an assessment of the completion objectives.
- Advanced analysis of microseismic data yields information on fracture networks such as distribution, persistence and orientations, and can describe the mechanisms behind the fracture growth leading to a better understanding of reservoir behaviour.
- ASC provides a full integrated processing service from array design, through data management, processing and reporting to advanced interpretations with dynamic numerical models to better understand the growth and activation of the fracture structures.

## Services for the Petroleum Industry

ASC has pioneered the application of microseismic technologies to petroleum field development through its Enhanced Microseismics Technologies and its hardware-independent processing and analysis software.

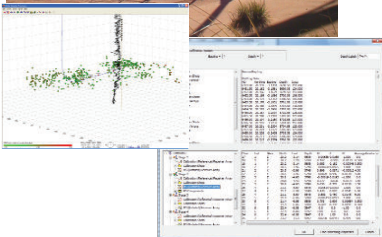


Our full integrated microseismic processing service can provide array design, through real-time processing, results, interpretation and correlation of the data with dynamic numerical models of the fracture network and mechanics:

- Pre-survey design of monitoring configuration;
- Real-time data processing and analysis providing feed-back on the position, growth and effectiveness of the stimulation;
- Quality assurance of pre-processed data sets;
- Full post-processing and reporting;
- Enhanced microseismic analysis applying methods developed through our research program at the cutting-edge of commercial microseismic applications;
- Construction and interpretation of geomechanical numerical models for better understanding of the fundamental behavior behind successful reservoir development.

ASC provides the industry's leading hardware-independent microseismic software package, PetroSeis, that includes standard tools as well as advanced analysis options for do-it-yourself processing.

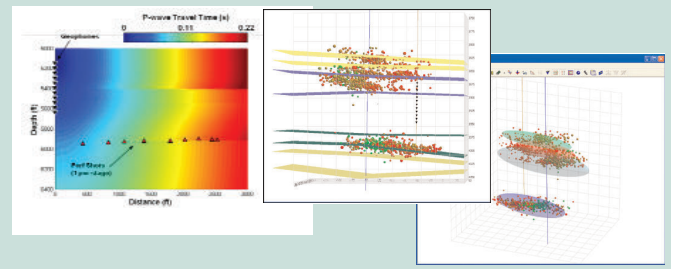
## Experience and Innovation



Some of ASC's earliest projects involved microseismic monitoring in petroleum fields and since then the company has continued to work in the sector on a broad range of projects. ASC geophysicists have carried out real-time monitoring of hydrofracture injection as well as routine and enhanced analysis of data off-site. Our experience covers a wide variety of completions, acquisition geometries and treatments, employing novel processing techniques where necessary to improve the quality of information fed back to treatment design.

Integrating our microseismic processing expertise with the geotechnical modelling capabilities of other Itasca offices, we are also pioneering the concept of fracture network engineering to optimise injection design for enhanced oil recovery.

## Microseismic Processing



We continue to develop unique algorithms for managing and processing microseismic data from hydrofracture treatments and whole-field monitoring.

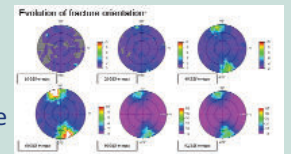
ASC's processing tools are independent of the acquisition system, providing flexibility to input different formats of microseismic data while using the same processing functions.

ASC has developed processing tools and techniques that enable a more complete imaging of the reservoir fracturing process:

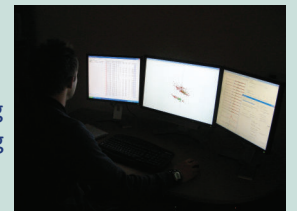
- Flexible waveform filtering and robust picking methods to detect and process events with lower signal-to-noise ratios.
- Location algorithms robust against the availability of full information from P and S-wave arrivals.
- Analysis of full microseismic streams, independent of event identification.
- Statistical analysis of fracture network geometry and clustering analysis to identify paths for fluid transmission.

## Applied Seismology Consultants

ASC specialises in providing commercial microseismic monitoring, processing and advanced analyses in a range of sectors including mining, radwaste storage, petroleum, geothermal, carbon sequestration, engineering, and laboratory testing. From May 2009 ASC is an Itasca International company.



Services are targeted at supplying an integrated work package along the full data path through sensor array design, data acquisition, processing and interpretation.



ASC's leading software, InSite, developed for over 10 years as a complete solution for ASC's consulting operations, is now used by many international organisations for in-house processing and management of seismic data.

ASC has a Quality Management System certified in accordance with the standard BS EN ISO 9001:2008.

