

Magnitude is an earth science company providing comprehensive microseismic monitoring services to industry worldwide. It operates in the oil & gas, mining & minerals and civil engineering markets. **Magnitude** provides consultancy and engineering services for monitoring underground gas storage, enhanced oil recovery, waste injections, hydraulic fracturing treatments and risks assessment. Services include design of the monitoring network, short-term monitoring surveys and permanent monitoring management. The company permanently manages the remote monitoring of 21 sites worldwide.

- **Expertise & consultancy**

With over 20 years experience in seismology, **Magnitude** and its key personnel provide expertise and consultancy for all type of passive microseismic projects. **Magnitude** has successfully introduced microseismic monitoring from treatment well and the associated leading technology in the oil fields. **Magnitude** is frequently involved in the validation of methods or technologies for microseismic monitoring surveys (Ex. F.O. sensor validation or passive tomography audit...)

The consultancy provided concerns:

- **Feasibility & Design studies**
 - Monitoring network design (*from observation & treatment well, from dedicated boreholes...*)
 - Microseismic analysis method & design (*genuine microseismicity, acoustic emission, consistent noise.*)
 - Monitoring procedures design (*Routines & risk assessment procedures ...*)
- **Microseismic project review**
 - Review of suitability of means with respect to objectives (*Design review*)
 - Q.C. & technical audit (*Third party audit*)

- **Microseismic Surveillance Services**

Taking advantage of 20 years feedback in continuous monitoring management gained from mining industry and underground gas storage, **Magnitude** proposes discrete time-lapse surveys and long-term continuous monitoring services to oil industry. With presently 21 sites permanently managed, representing over 100 000 induced microseisms processed a year, **Magnitude** is the leader in continuous microseismic surveillance services. **Magnitude** provides a range of services from the validation of monitoring network installation to the interpretation of seismicity and the data management.

The services proposed are:

- **Supervision & assistance for monitoring network commissioning & start up**
 - Downhole seismic tools QC including calibration, orientation & coupling check
 - Acquisition system commissioning & start up
 - Implementation of Monitoring procedures
- **Data acquisition management - Remote-monitoring & follow up.**
 - Remote acquisition health check & QC
 - Periodical reporting based on automatic data screening & pre-processing
 - Data management & storage history
- **Microseismic processing, analysis & interpretation**
 - Classification & characterization of records
 - Background noise analysis & sensitivity analysis
 - Seismic events processing, 3D location & seismicity distribution analysis

- **Microseismic monitoring - Integrated project management**
In addition to follow up assistance and data gathering & interpretation, **Magnitude** proposes the following integrated project management:
 - Stability control - Microseismic network in dedicated boreholes
 - Injection monitoring - Pilot phase from observation well
 - Hydro-fracturing - Fracture mapping from observation well or treatment well

- **Microseismicity Application Courses**

As an introduction or an extension to microseismic surveillance services and monitoring network commissioning & start up, **Magnitude** provides course and training sessions:

- **Introduction to passive induced seismicity** (one day course)
- **Underground Gas storage surveillance** (introduction & training - 3 days course)
 - Introduction to Microseismic surveillance & stability control.
 - Training course “Microseismic acquisition & monitoring procedures”

- **Microseismic R & D**

From its early days, research capability, innovation and research partnerships are the keys of the **Magnitude** development. **Magnitude** is involved in numerous R&D project:

- **Signal processing, seismology and passive seismic**
(Permanent surveillance feedback & in house development)
Effective research Partnerships with:
 - Geosciences Azur
 - Ecole des Mines de Paris
 - Laboratoire des Images et des Signaux
- **Tool expertise and design**
(Micro-seismic need/ tool design)
- **Remote follow up management**
(Remote follow up, pre-processing and automatic management)
- **Methodology and Hydro-fracturing job**
(Monitoring from treatment well - Integrated monitoring approach)
- **R&D consortium:**
 - PHASE: “Microseismic interpretation”
 - ANR: “CO2 Sequestration”
 - IFREMER, CNRS and TOTAL: “Relationships between fluids and seismicity”