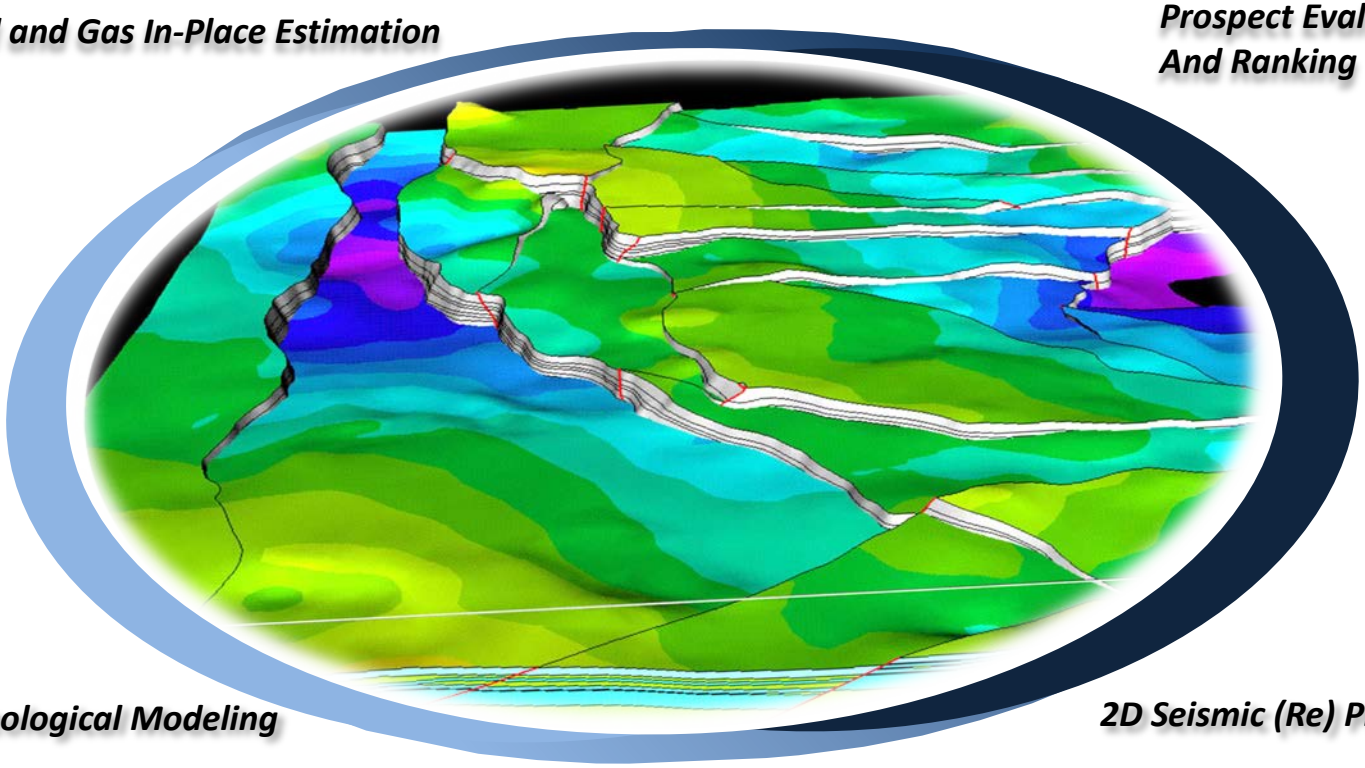
Oil and Gas Prospect Evaluation Services

EOSYS

Reservoir Analysis

Oil and Gas In-Place Estimation

Prospect Evaluation And Ranking



3D Geological Modeling

2D Seismic (Re) Processing

Petrophysical analyses

2D/3D Seismic (Re) Interpretation

Well Log Interpretation

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EOSYS has developed over the years a range of consultancy services to assist operating companies or investment groups in assessing the exploration potential of hydrocarbon prospects or the development of oil / gas fields with present or past production.

EOSYS offers the following services

- **Exploration prospect assessment – Target identification and Ranking**
- **Exploration prospect assessment – Analysis of Fluid Migration from Source to Trap**
- **Drilled prospect assessment - Accurate estimation of hydrocarbons in place**
- **Design/Check of Well Trajectory**
- **Site Surveys for Surface Facilities (pipelines, plants, surface & underground storage...)**

The following technologies are used in house:

- **3D Geological Modeling**
- **Static/material balance reservoir evaluations**
- **Well log interpretation and petrophysical analysis using commercial software.**
- **2D and 3D seismic interpretation**
- **2D seismic processing**
- **Seismic acquisition**

Consulting Services

Exploration Prospect Assessment

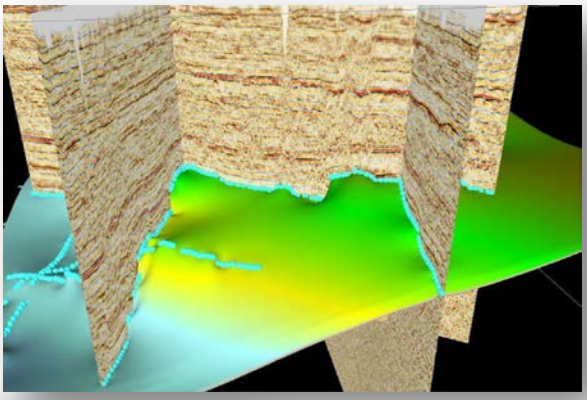
Target identification and ranking

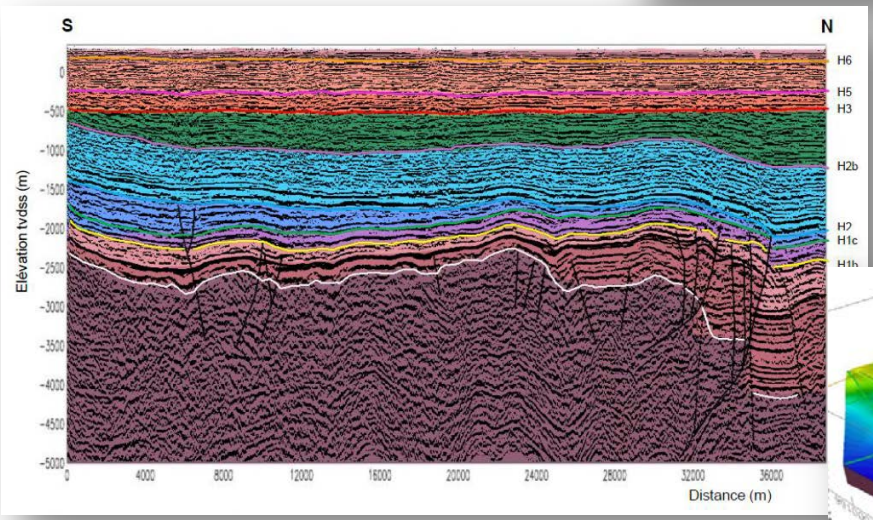
EOSYS carries out multistage approach in the identification and assessment of hydrocarbon potential over a prospect area.

The first stage consists in a 3D synthesis of all available geological, geophysical and drilling data to outline the most interesting areas of prospect zone. If required, new seismic acquisition surveys may be designed over prospect areas.

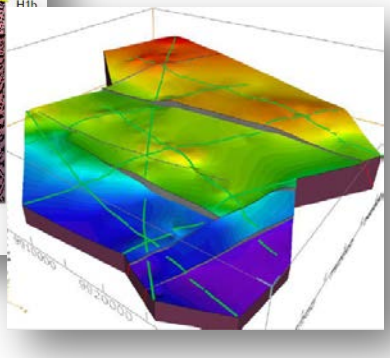
The second stage consists, if required, in the re processing and re interpretation of the seismic data, synthesis of all available geological data building up of 3D geological time and depth models.

The third stage consists in the identification of the possible hydrocarbon traps (structural, stratigraphic) and seals, to assess their resource potential.





Seismic Processing and Interpretation- Prospect Identification and Ranking Congo Basin



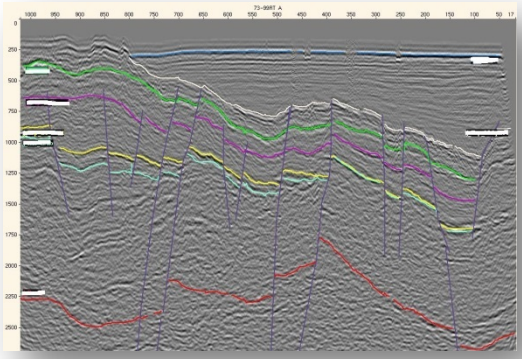
The last stage consists in target evaluation and ranking based on target size and exploration risk and in the selection of candidate drilling sites.

References:
- PILATUS ENERGY, Suisse – N'Goki (Congo) : Prospect identification
- Private investors,–Claim stacking, target evaluation

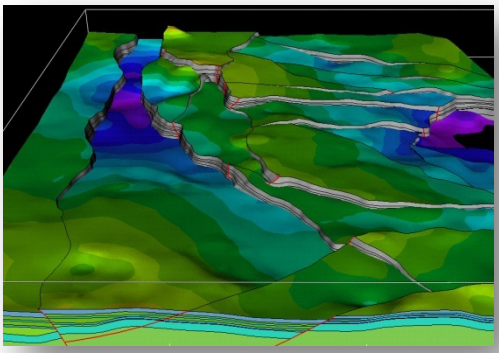
Exploration Prospect Assessment

Analysis of Fluid Migration from Source to Trap

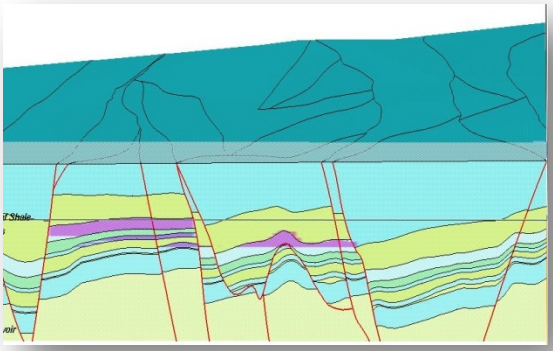
EOSYS has developed in house cellular automaton programs that allow to simulate the percolation of hydrocarbons from source rocks in complex 3D geological models. This allows to investigate all potential reservoir closures with different scenarios concerning the fluid pathways. For example, the effect of fault or seal permeability can be tested and the potential prospect size defined accordingly. This is a powerful tool in order to assess the exploration risk and to rank exploration targets.



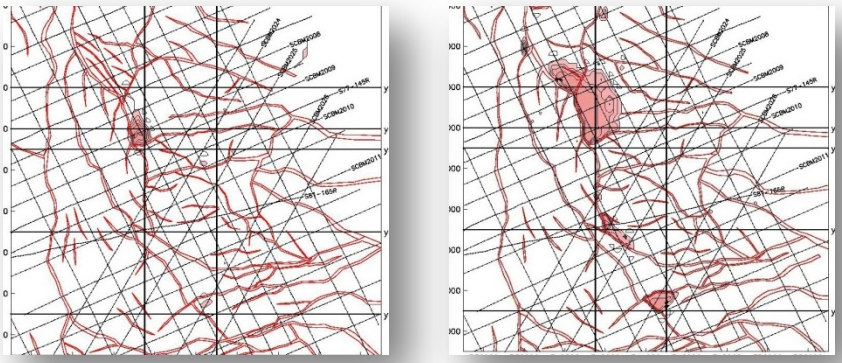
2D raw seismic interpretation loaded from client's exploration service



3D geological model after interpretation check/adjustments and time to depth conversiont



Cross section of the fluid model showing the potential accumulation of hydrocarbons



Oil thickness map for 2 hypothesis : permeable faults or non permeable faults

References:
- LUNDIN (COPAREX), France – Thelepte (Tunisia) : Drilling target assesment
- Various private investors: Exploration target /field development assesment

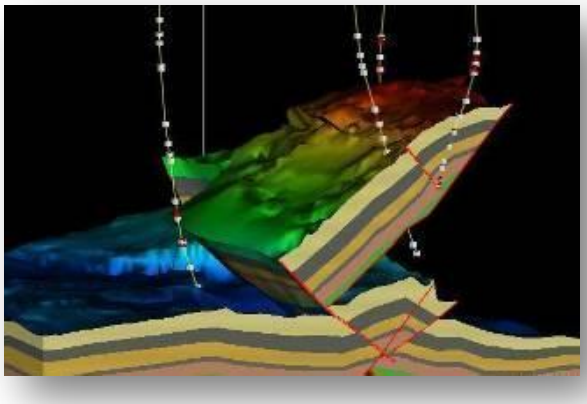
Drilled Prospect Assessment

Accurate Estimation of Hydrocarbons in Place

Since 1993, EOSYS has been at the forefront of the innovation in building 3D geological models for exploration and development projects.

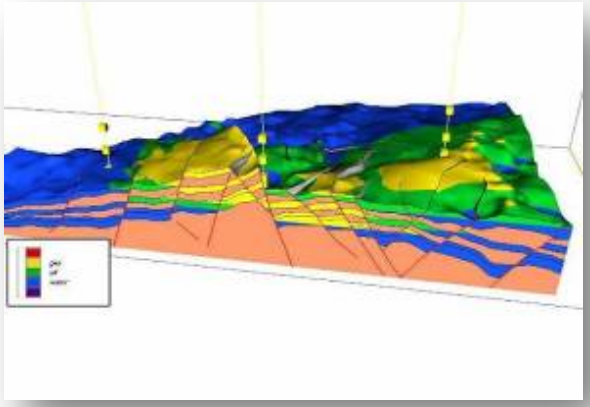
The in house methodology blends stratigraphic and structural models based on well, seismic and surface data in order to build prospect or reservoir models. Time to depth conversion can be made at various stages and reprocessing and/or reinterpretation of seismic data may be made in house before finalizing the final model.

Fluid contacts based on well or seismic data are entered and allow accurate estimate of the original gas or oil in place as well as of the geometry of the reservoirs.



3D Structural, Stratigraphic and fluid Modeling
Time to Depth Conversion
OOIP, OGIP Calculation

Cupiagua Field- TOTAL Colombia (above)
Birsa Field- COPAREX Tunisia (below)



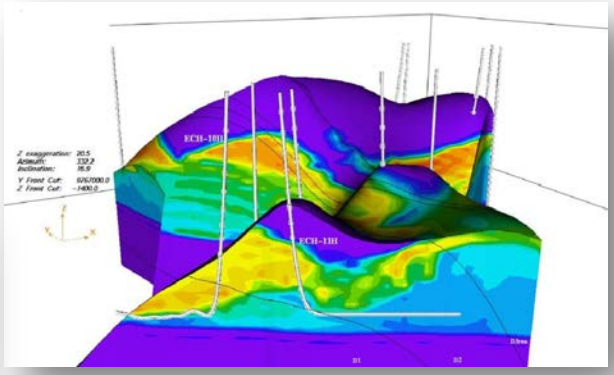
These detailed models are used for accurate resource estimate, exploration or field development strategies, well design and/or monitoring.

References:
- LUNDIN (COPAREX) Tunisia : Oudna / Birsa : Resource estimation
- ENGIE (GDF SUEZ) Algeria : Rhourde Nouss / Gassi Touil / Ahnet / Reggane : Reserve estimation
- PERENCO Gabon : Oguendjo : 3D geological modeling
- TOTAL UK : Markham : Resource estimation
- TOTAL UK : Alwyn, T Block : 3D geological modeling
- TOTAL Colombia : Cupiagua : 3D geological modeling

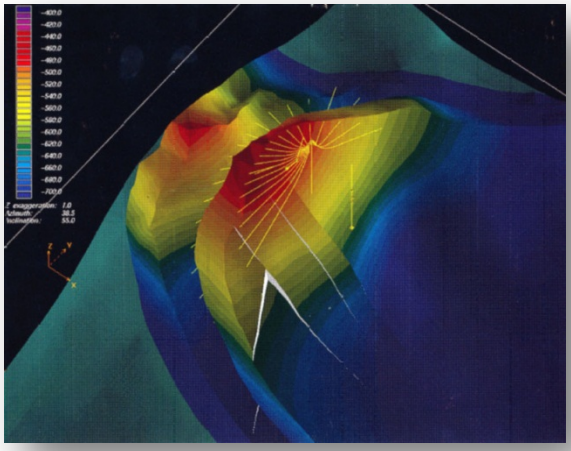
Design/Check of Well Trajectory

During the development of an oilfield, it is often more economical to drill a number of directional wells from a single platform than to drill vertical wells from individual platforms. In these cases, a 3D geological model is a powerful tool to establish the dialogue between geologists, drilling engineers and reservoir engineers.

EOSYS developed a set of in-house procedures to calculate accurate targets within the reservoir which can be reached from a single drilling platform considering the design parameters of directional drilling (kickoff point, build-up rate and final drift angle). Well trajectories can be easily calculated, visualized inside 3D geological models and modified following the recommendations of all professionals involved in the project.



3D geological model filled with oil saturations resulting from reservoir simulations and used to position future horizontal drillholes

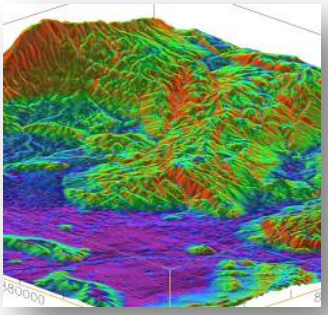


Possible well trajectories

Site Surveys for Surface Facilities

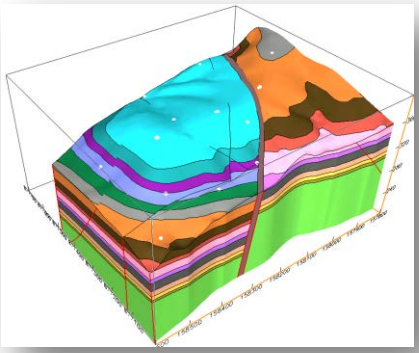
(pipelines, plants, surface & underground storage…)

EOSYS offers geological services and consultancy for preliminary studies, construction and maintenance for hydrocarbon infrastructure projects.



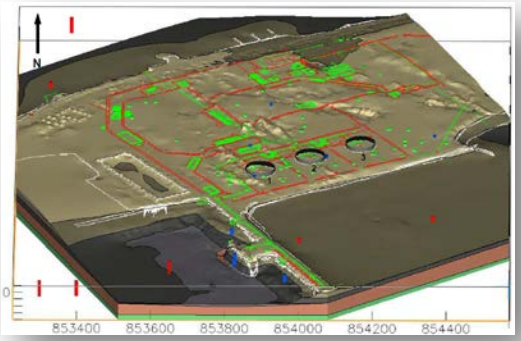
Preliminary studies:

- **Geomorphological investigations**
- **Natural hazards**
  - **Detection of seismically active zones**
  - **Landslide zone detection**



Construction:

- **River crossing**
- **Geomechanical properties of terrain**
- **Natural drainage system**
- **Cavity detection**
- **Groundwater location, geometry and vulnerability**
- **Detailed 3D geological modeling**



Maintenance:

- **Simulation of pollution**
- **In-situ seismic surveys**

References:
- AL THANI CORP, Tunisia – Kerkennah Islands (Tunisia) Satellite image processing & interpretation
- ENGIE (GDF/SUEZ), France – Touat Field (Algeria) Satellite image processing & interpretation
- ENGIE (GDF/ SUEZ), France – Fos-sur-Mer (France) Gas storage analysis and modeling
- ENGIE (GDF/ SUEZ), France – Soings-en-Sologne (France) Gas storage and modeling
- ENGIE (GDF/ SUEZ), France – Hauterives (France) Acquisition, processing & interpretation of 2D seismics
- GEOSTOCK, France - Loehnout (Belgium) Structural analysis & Gas cap modeling
- PERENCO, France– Rembo Kotto(Gabon) photogrammetry and structural analysis of surface data
- TOTAL, France – Lussagnet (France) Acquisition, processing & interpretation of VHR seismic data
- TOTAL, France – Bugungu (Ouganda) Acquisition, processing & interpretation of VHR seismic data

Technologies

Technology - ***3D Geological Modeling***

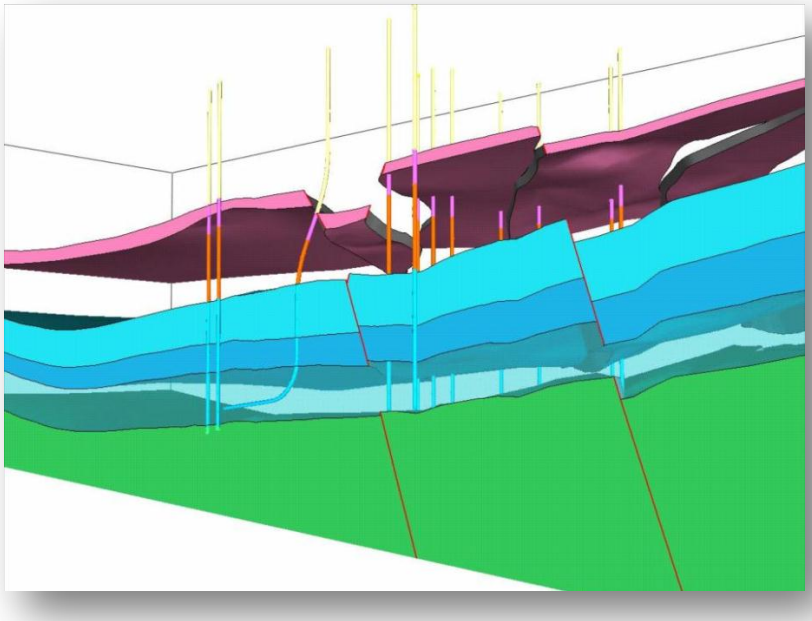
EOSYS performs the integration of surface data (satellite, topographic, geology, structure…) and subsurface data (seismic, drillhole) in order to create consistent 3D geological models at project scale. Commercial software such as EarthVision or client's designated software (Petrel, Gocad,…) are used for that purpose.

These 3D models allow checking data coherence and give an accurate description of geological structures.

Once validated model, EOSYS can perform:

- **Exploration target evaluation**
- **Resource estimation**
- **Well trajectory design**
- **Geostatistical studies**

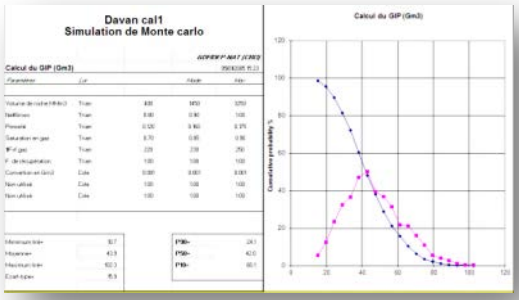
These models can also be used by other specialists who wish to perform reservoir simulation, geomechanical or geotechnical analyses.



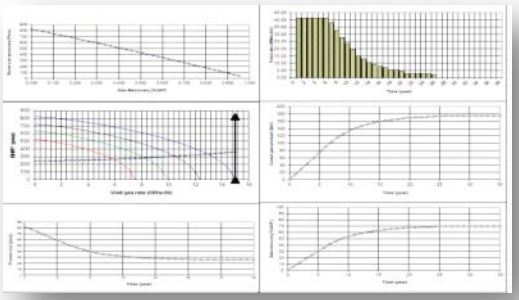
3D Geological model (Hauterives, France)

Technology - ***Reservoir Analysis***

EOSYS can provide in house static/material balance reservoir evaluations or call on external consultants for decline curve analysis or reservoir simulations.

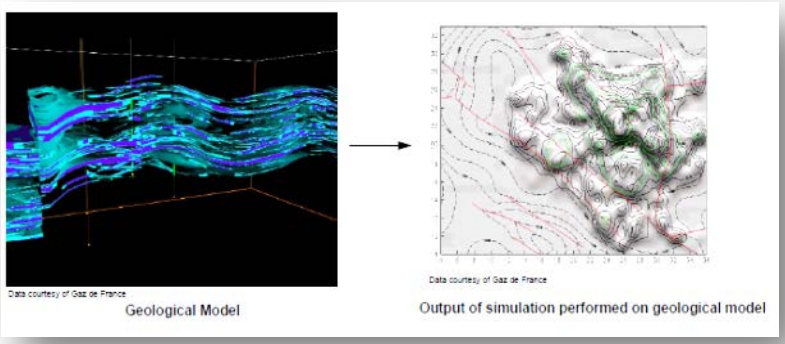


Monte Carlo Resource Simulation



Material Balance Calculation

The combination of these technologies allows to detect and to unlock zones of bypassed hydrocarbons in mature fields. Using EOSYS's services, operators or investors can assess their exploration or development risks as well as maximize their return on investment.



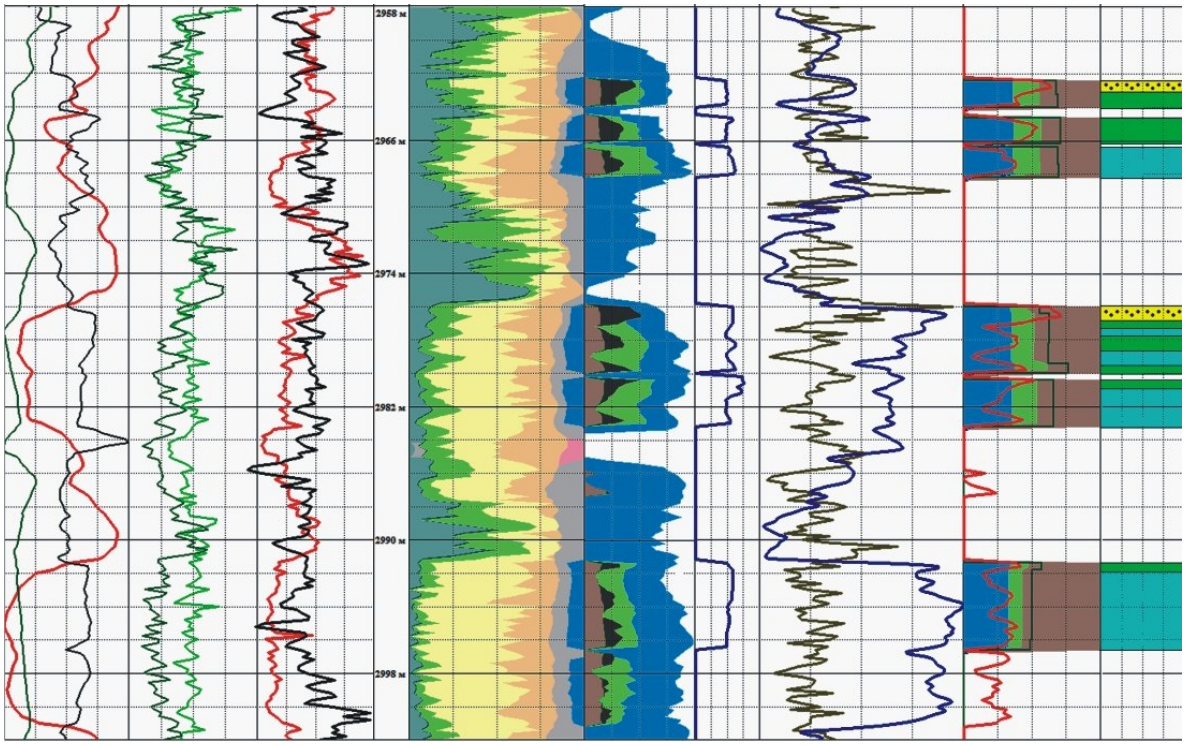
Preparing 3D models to define reservoir management strategy.

Technology - ***Well Log Interpretation and Petrophysical Analysis***

EOSYS can perform well log lithological and geochemical interpretation coupled with petrophysical analyses using commercial software (Strater / Rockware and other software).

EOSYS is able to provide well engineering studies with:

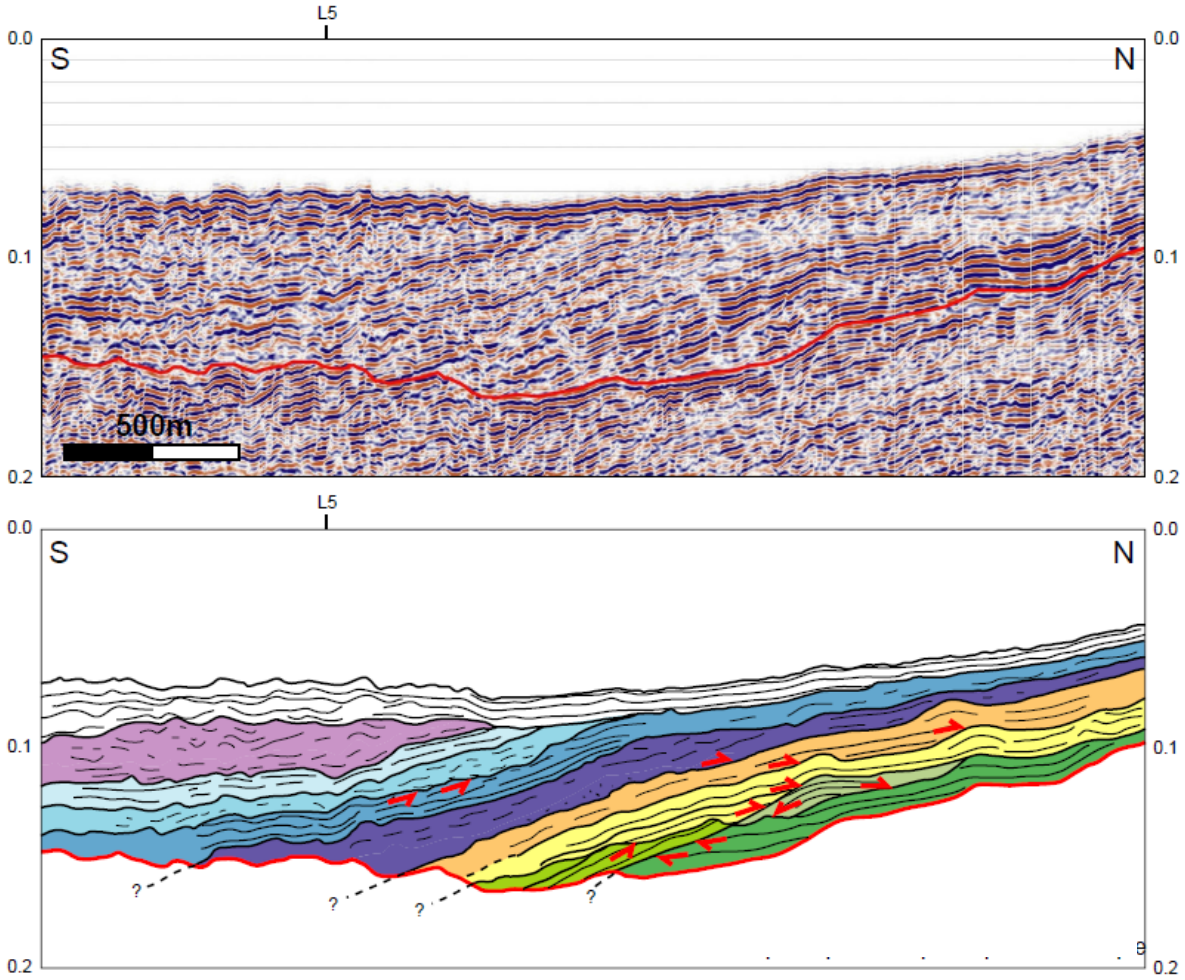
- ***Detailed trajectory design based on local well 3D geological model***
- ***Well and log prognosis***
- ***Update of well prognosis while drilling***
- ***Productivity index and drainage area analysis***



*Technology - **2D/3D Seismic (Re) Interpretation***

EOSYS can provide 2D and 3D seismic interpretation (Open Dtect / DGB and other software) in order to:

- **Define new play concepts**
- **Define or control the tectonic framework in a field**
- **Better position seismic surveys and wildcats**
- **Define injection patterns taking into account existing faults and fracture geometries**



Seismostratigraphic study (Carry-le-Rouet, France)
Offshore seismic acquisition performed and processed by EOSYS

Technology - ***2D/3D Seismic (Re) Processing***

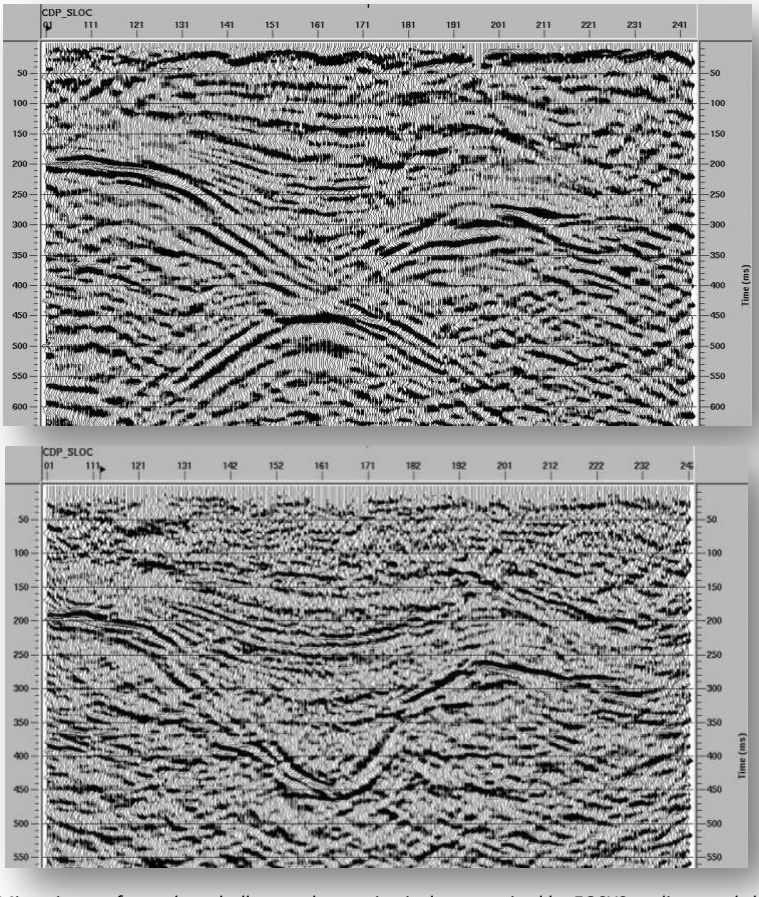
EOSYS has developed innovative processing sequences in order to handle terrestrial data with difficult static corrections.

EOSYS is able to process:

- **Vertical seismic data (PSV),**
- **2D/3D seismic data at different resolutions (HR/VHR) at regional or local scale,**
- **Refraction seismic data**
- **Time-to-depth conversion**

Equipment:

- **2 permanent licenses of Landmark PROMAX processing Software allows 2D, 3D and mini-VSP processing**
- **A Tezro multi-processor workstation, Silicon Graphics O2 and IBM workstations are used in the processing center**
- **in house programs and various other commercial softwares**



Migration performed on shallow onshore seismic data acquired by EOSYS outlines real channel

*Technology – **Seismic acquisition***

EOSYS is able to perform or manage onshore or offshore acquisitions with adapted source and equipment. Samples of land acquisition:

- 2D Seismic Reflection
  - Very High Resolution Seismic : sampling of ¼ to ½ ms, intertrace between 1 and 5 m.
  - High Resolution Seismic : sampling of 1 ms, intertrace between 5 and 20 m
  - Conventional Seismic: sampling of 2 to 4 ms, intertrace between 20 and 100 m
  - Crustal Investigations / ECORS

- Seismic Refraction
- Mini-VSP (Vertical Seismic Profile)
- Drilling
- Topography
- Real-time quality control acquisition

Seismic acquisition on a glacier (France)

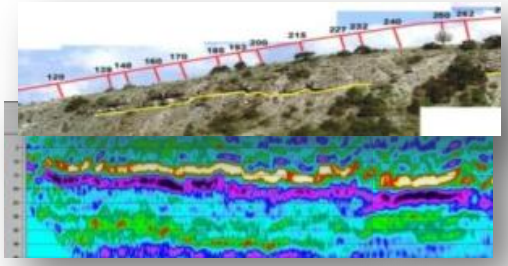
Equipment:

- 24 bits POLYSEIS laboratory (IFP trademark), 460 numeric channels with radio or line transmission;
- A SERCEL SN338 HR with 96 channels lab;
- Sources: in house portable vibratory source (depth 5m to 500m), truck mounted vibratory sources, dynamite, mass.

EOSYS has performed/supervised surveys in difficult acquisition conditions such as plant sites or equatorial swamp zones.

Depending on the objectives, EOSYS can implement directly or through certified subcontractors, other geophysical methods: electric, electromagnetic, gravity, magnetic, geo-radar...

Seismic acquisition on industrial site



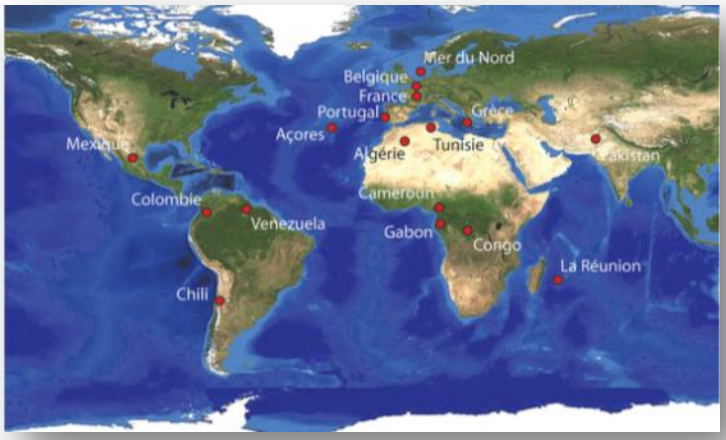
High Resolution Seismic Field Experiment with TOTAL and ARMINES

Active in Mexico since 2006, EOSYS contributes to facilitate and secure the flux of foreign investment that this country now allows in order to develop its hydrocarbon industry.

With offices in France and in Mexico, EOSYS can assist investors or independent operators in their ventures in Europe, Africa or Latin America.

References

- **TOTAL**
- **ENGIE (GDF SUEZ)**
- **PERENCO**
- **IFPEN**
- **GEOSTOCK**
- **SOLVAY (RHODIA)**
- **NOVACARB**
- **LUNDIN (COPAREX)**
- **Private Investor groups**



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