

Ceres 2D

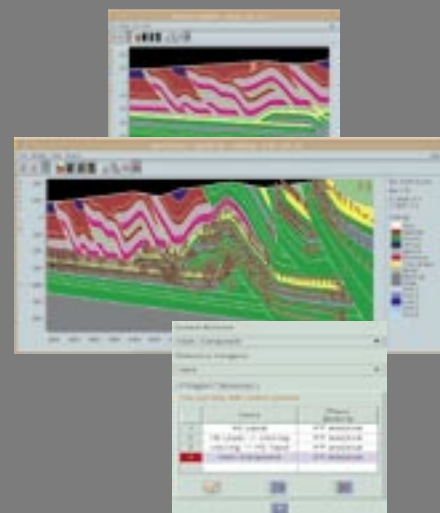
2D Basin Modeling in Any Structural Setting

The solution to rigorously account for the role of faulting in basin deformation and quantifying its impact on pressure regimes and hydrocarbon migration.

Ceres allows explorationists to model sedimentary basins and understand petroleum systems in complex structural environments such as salt-driven tectonic areas, fold-and-thrust belts and deltaic systems.

Applications where Ceres has improved our understanding of petroleum systems and reduced exploration risk include:

- Sensitivity analysis of hydrocarbon migration to faulting in the Bolivian foothills, the West African margin (offshore Congo and Niger delta) and northern Venezuela;
- Reconstruction of pore pressure distribution and hydrocarbon migration in the Caspian Sea, and in sub-thrust reservoirs in the Canadian and Bolivian foothills;
- Assessment of salt-tectonic effects on hydrocarbon migration in deep water Gulf of Mexico.
- Understanding of structuration versus hydrocarbon migration in a fold-bend-fault structure in Venezuelan foothills



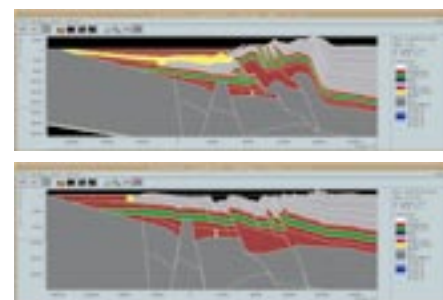
CERES 2D BENEFITS FROM:

- Time-to-depth conversion of geological and seismic data;
- Links with standard structural modeling software applications such as Locace, 2D Move and GeoSec;
- Innovative compaction modeling based on pressure-solution algorithms;
- Advanced fault behavior modeling;
- Permanent research efforts from IFP.

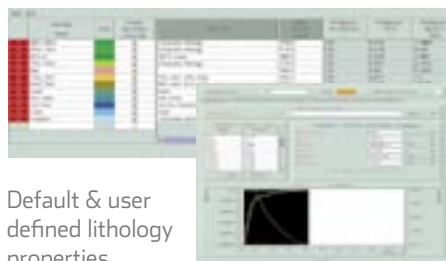
Structural framework (horizons, faults) are imported from standard seismic interpretation platforms or structural modeling packages. Present day litho-stratigraphic model is then interactively built incorporating geological markers (i.e.: stratigraphic horizons, faults) and geological attributes such as lithology distribution including lateral facies variations.

Present day section is restored through a step by step process accounting

for deformation's kinematic, backstripping and thickness variations. Past geometries can be controlled using templates resulting from third party restoration software packages or forward modeling software such as Thrustpack. Deformation associated to salt tectonics, mud diapirism, vertical and lateral displacements are handled. In the backstripping process sedimentation and erosion are considered using porosity-depth laws.



Present day and restored section



Default & user defined lithology properties

Forward modeling is then performed coupling the following phenomena:

- compaction and resulting de-watering using respectively pressure-solution algorithm to describe porosity variation and Darcy's law for water flow ;
- transient conductive and convective heat transfer in areas where thermal perturbation due to surface water charging needs to be considered;
- compositional hydrocarbon generation using exclusive IFP kinetics as well as standard ones;
- hydrocarbon migration using multi-phase Darcy's law.

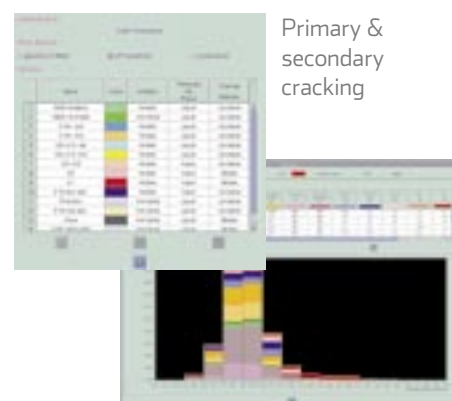
Hydraulic behavior of faults, and its impact on pressure field and hydrocarbon migration is flexibly handled. Faults can be fully permeable or fully impermeable.

Alternatively fault permeability can be described as a function of displacement of structural units along the fault; or as a function of pressure and stress.

Ceres finite volume scheme offers the robustness and reliability required for multi-phase Darcy's flow modeling which is the only solution to rigorously understand the interaction between trap formation and hydrocarbon generation/expulsion in fold-and thrust-belt.

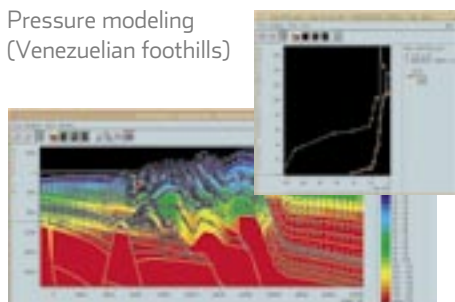
Ceres viewer allows manipulating any calculated properties through time for an efficient and easy results analysis:

- Display of seismic and patrimonial data on the modeling results;
- Geological section and any property distribution through time;
- Multi- Well log (property vs. depth);
- Grid cell history (property vs. time);
- Value sampling in grid cells;
- Observed data editor & viewer for calibration.



Primary & secondary cracking

Pressure modeling (Venezuelian foothills)



Ceres offers several possibilities for exchanging information with other application at pre-processing, processing and post-processing stages:

- Import of unformatted and formatted ASCII files from leading

interpretation systems (Landmark, Geoquest), structural modeling packages (Locace, 2DMove and GeoSec) & digitization of paper section;

- Export of modeling results as ASCII file & CGM and Postscript plotting capabilities.