COMPUTE 3D FACIES PROPORTIONS WITH ISATIS
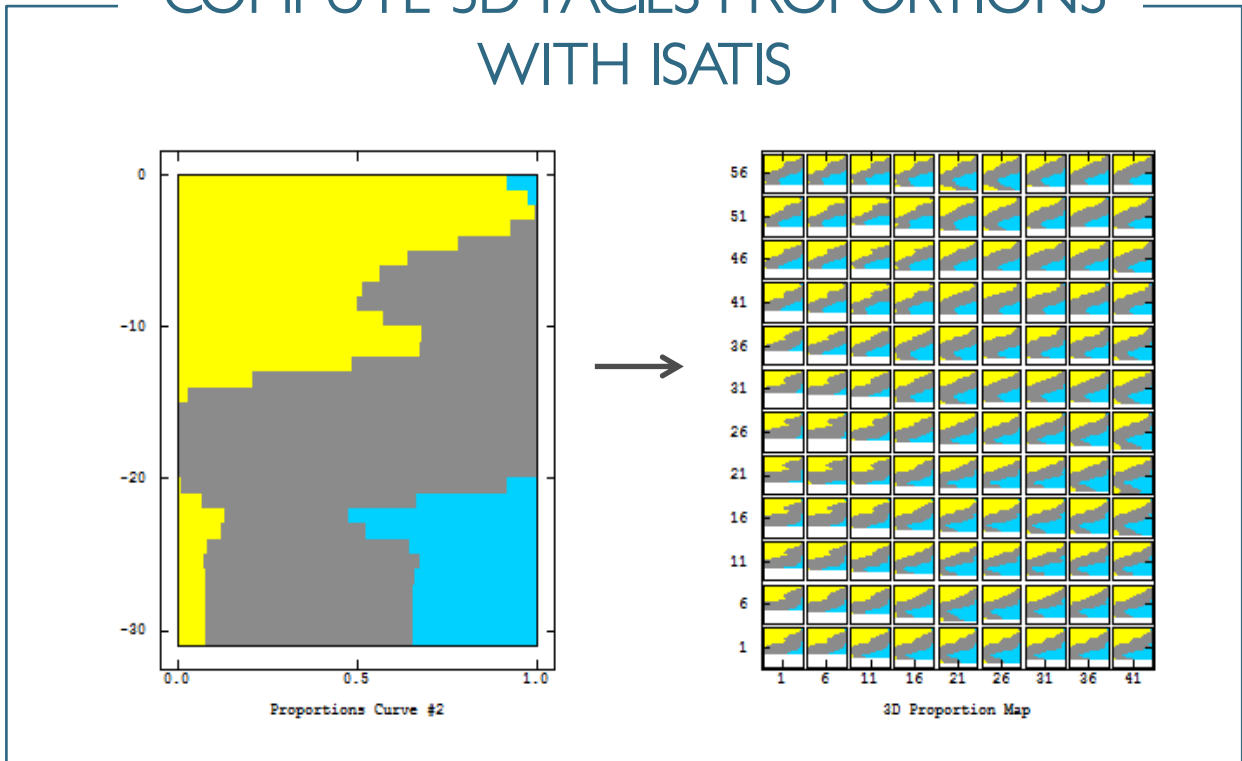

3D facies proportions play an important role in facies modelling.

3D facies proportions can be used as a direct constraint in facies simulations techniques such as plurigaussian simulations, sequential indicator simulations, multiple-point statistics simulations and meandering channel simulations, the way of integrating facies proportions depending on the simulation method. By integrating facies proportions, non stationarity in facies distribution can be input in the facies simulation process. Computed from local proportion information at wells, 3D facies proportions are able to capture changes in facies distribution in the whole reservoir unit.

The dedicated window to compute 3D facies proportions in isatis is available in:

➔ Statistics → Statistics → Proportion Curves

The following actions can be made from this window.

1. Input Data

- Wells with lithotype codes: the lithotype proportion data will be computed from the well information.

- 2D average proportion map (optional): A 2D proportion map can be used to constrain the vertical mean proportion of one or several lithotypes. Such a map can be calculated, for example, from a regression with a seismic attribute (as acoustic impedance).

2. Vertical Proportion Curve(s)

Facies proportion information is calculated from the wells. The vertical proportion curve (VPC) gives access to the proportions of the different facies in the different layers of the stratigraphic reservoir grid (see Figure 1 below).
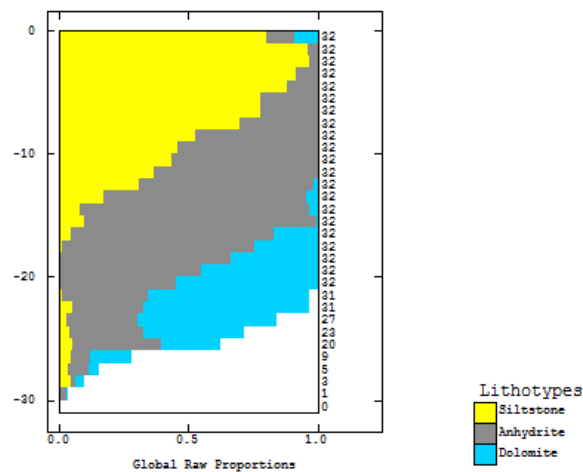

Figure 1: A vertical proportion curve

It is interesting to look at the local distribution of facies over the whole reservoir unit. If there is a non-stationarity in facies distribution, local VPCs may be computed. Displaying the pie proportions per well (**Application \ Display Pie Proportions**) helps identifying the spatial facies distribution. Afterwards local VPCs can be computed to account for the facies proportions variations (see Figure 2)
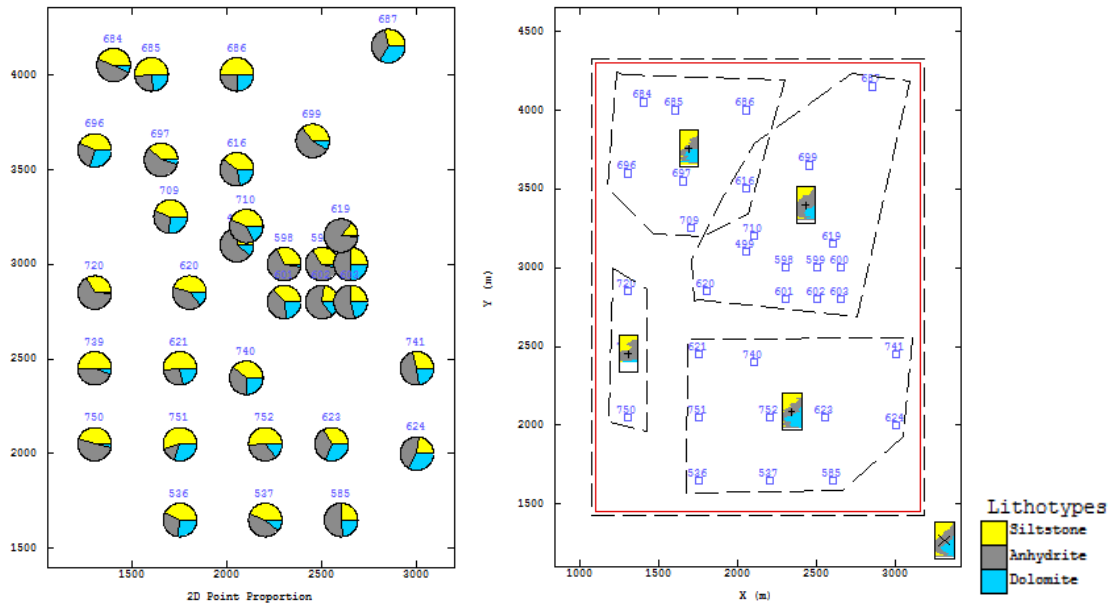
Figure 2: Pie proportions (left) and discretization of local VPCs (right).

To compute local VPCs, polygons are discretized (**in the Polygon Edition mode**) grouping one or several wells. The facies proportions are then calculated level per level from the selected well(s) and a VPC is created at the gravity center of each polygon.

It is often necessary to complete the local VPCs, if for example, some wells are not crossing the whole reservoir unit. Completion is run (if needed) for each local VPC (**in the Vertical Proportion Curves edition mode**). There are two ways of completing a VPC:

- Automatic completion: It consists in an averaging of several previously filled layers (number chosen by the user). The same calculated proportions are copied to all the empty levels (**right click menu: completion**).

- Manual editing: Each local VPC can be edited manually and completed by the user (**right click: Editing mode**). The user can set up at each VPC's level the proportions of each facies.
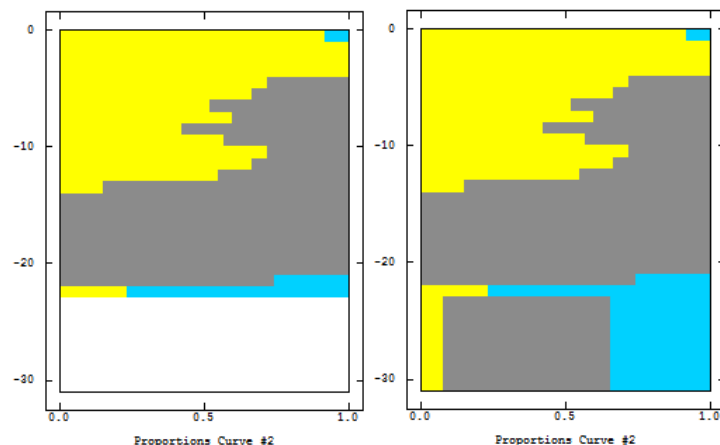

Figure 3: A raw VPC (left) and automatically completed VPC (right).

After completion and sometimes also due to data configuration, a VPC can present some abrupt changes of proportions that are not relevant geologically. That is why a smoothing tool is available (**right click: smoothing**). A moving average of proportions between the different levels is made, removing strong facies proportion variations from one level to the next level in the VPC.
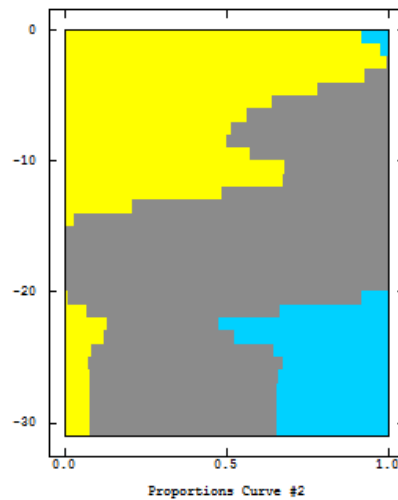

Figure 4: A smoothed VPC

As soon as the VPCs are completed and updated, the 3D proportions can be modelled. In order to better constrain the proportion distribution, the VPCs can be edited, copied, moved over areas not covered by wells.

3. 3D Facies Proportions Modelling

On each target node of the stratigraphic grid, facies proportions are interpolated either by kriging or by inverse of squared distance interpolation method (in **Application\Compute 3D Proportions**). A level per level (horizontal) interpolation is done from the local vertical proportion curves. This is done using all the VPCs (unique neighborhood).

At this stage, a 2D average proportion map can be used to constrain the proportion modelling. The vertical mean proportion of the selected facies will follow this 2D constraint.

For more information, contact our consultants at consult-oil@geovariances.com.