CLOSING THE GAP… BY CODIFYING WHAT EFFICIENT TEAM WORK SHOULD BE IN GEOMODELING PROJECTS

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1. INTRODUCTION.

By nature, geomodeling relies heavily on the mathematical techniques implemented in geomodeling packages. Nowadays, we are blessed by how powerful these algorithms have become. 3D implicit modeling (1), also known as volume-based modeling (2), allows us to model even the more complex fault network without the burden of having to simplify it. This approach also provides us with new tools for restoring the structure (3), even restoring the 3D seismic cube, which help us interpreting it. Geostatitics have evolved too, software companies having implemented multi-points geostatistics (4) and local geostatistics (5) in their geomodeling packages. If anything, our challenge nowadays as geomodelers is to pick the right tools out of this massive toolbox that geomodeling packages have become.

But beyond the marvels – and the remaining challenges – that geomodeling has become, building a geomodel fundamentally remains a team project in which the geomodeler must collaborate with other stakeholders to ensure the geomodel captures all the team's data and understanding of the reservoir while providing an answer to the problems the team try to solve. Input data and interpretation mostly come from the team's geoscientists (geophysicist, geologist, geophysicist) and the problems are usually asked by engineers and concern things such as in-place volumes and how the reservoir can be best produced. All of this work is further supervised and observed by other stakeholders such as the asset team manager and the other teams and managers, who wait for reports which will feed their own reflection, work and decisions.

To be efficient, a geomodeler must not only master the science and the software, but maybe more important, he/she must master project management and team work. This poster focuses on team work, and more specifically on how to optimize the communication with the other stakeholders.

2. ARE 3D VIEWS REALLY THE BEST WAY TO COMMUNICATE ABOUT A MODEL?

Geomodelers build 3D grids. And yet, using only pictures of 3D views of such models is not always enough to carry the whole story, as can be seen in FIG 1, 2 and 3, taken from Figure 18 of (6). The authors' figure (FIG 1) combines a 3D view with a map, a facies proportion histogram and a VPC. Had they only shown the 3D view (FIG 2), one would get a global, qualitative sense of the authors' 3D model, but it would have been difficult to understand details, much less extract quantitative information such as the dimensions of the different facies geobodies or the location and distances between the wells. Had they only given us the 2D map (FIG 3), one would be able to quantify the characteristics of the reservoir, but at the cost of having a hard time building a 3D mental image of the structure. This is the association of the 3D view with the 2D view (FIG 1) which provides both the general qualitative understanding of the model and the quantitative details one could extract and use for additional work.

FIG 1

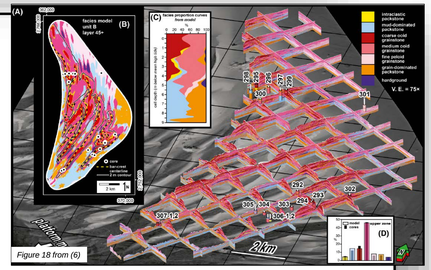

Figure 18 from (6)

As a general rule, if some pictures are meant for an audience to which the author don't want to share too much technical details, 3D views might be enough. But if the audience is made of technical experts, 3D views should be used only as a complement to traditional 2D views, if used at all. For example, in (6), the authors illustrated their paper with 20 pictures of which only 2 show some form of 3D view of their geomodel.

FIG 4 and 5 illustrate this further with a simple example. If the goal is to the structure of the top reservoir, what is the best picture? FIG 4 would be fine for non-specialists even if it shows very little information. FIG 5 would be perfect for geologists, but people not used to read contour maps would have a hard time picturing the horizon in 3D in their mind. Using both pictures would give the maximum impact. FIG 4 would just need to be edited to show the same color scale than on FIG 5 as well as similar black contours.

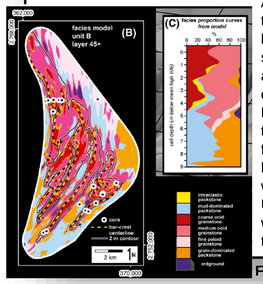

FIG 3

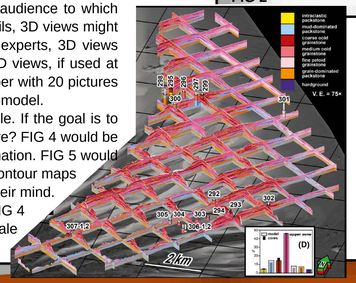

FIG 2

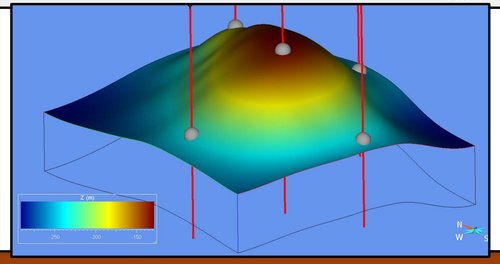

FIG 4

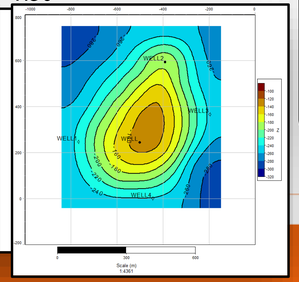

FIG 5

3. ENGAGE THE OTHER STAKEHOLDERS DURING THE GEOMODELING WORK ITSELF.

FIG 6

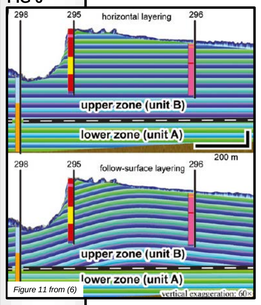

Figure 11 from (6)

"Dear geologist, what orientation do you want for the internal mesh of the 3D grid? Horizontal? Parallel to the top? To the base? Proportional?". From the author's experience, this question brings confusion to many geologists. A picture similar to FIG 6 helps make it clearer and a decision is taken one way or the other. But it does not prevent surprises during the final geomodeling presentation to the team on the line of "I really expected that shale on Well A to be connected to this shale on Well B and your model doesn't show it…" leading to further discussion and potentially rework of the geomodel.

The problem can be avoided if the initial discussion is rephrased as a question of well correlation inside the geological unit (FIG 7). Assuming some large vertical cell size, we can calculate the depth at which each well will be crossed by each horizontal layer of the 3D-grid. That information can be shown on a well correlation plot as well tops within the geological unit instead of more general cross-section such as on FIG 6. The geologist can import these new internal markers into his/her geological package.

This simple rephrasing allows two things. Firstly, as a geomodeler, we've made the effort to put ourselves in the shoes of our teammate. Geologists are trained in correlating wells. Now, they can apply their skills to checking which internal layering will capture better how the layer internal architecture should be connected from well to well. Secondly, they can do it in their own package. This is not anymore 2 persons working in front of 1 geomodelling package, but two geoscientists working together and in parallel in their respective specialized software.

Importing also these internal tops to the petrophysical package makes it even possible to collaborate with the petrophysicist and the geologist on finding the right vertical cell size which capture all the key characteristics of the reservoir as well as the ones which will be used for the upscaling going to flow simulation. Similarly, we can work with them on understanding the variation in the vertical proportions of the facies as well as the vertical trends in the petrophysical properties. Each of these problems is not anymore solved by the geomodeler in his/her software with the team as a witness. It is now a real team work.

This example illustrates that, with an effort in re-phrasing our challenges into terms and displays familiar to others, the team can increase its efficiency. Firstly, team work will limit the risk of mistakes. Secondly, the whole team will be more aware about (and so more likely to agree with) what lead to all the decisions made during the geomodelling workflow.

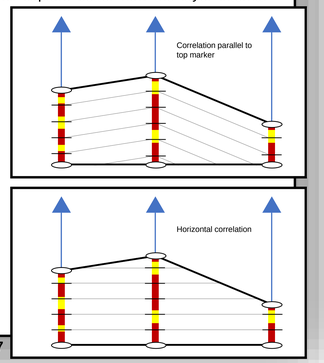

FIG 7

4. GETTING INVOLVED IN OTHER TEAM MEMBERS' WORK.

In the same way that our team win when we get others involved in our geomodeling projects, we can help our team by getting involved with the work done by our colleagues. For example, geomodelers can help validating to work done by petrophysicists. Once we know what petrophysical equations are being used in a given datasets, we can use these equations to review how they were applied. FIG 8 and 9 illustrate one example the author faced in a project recently. SW had been computed using the Archie Equation. A log-log RT vs SW display in the geomodelling package captured this. The points aligned as expected showing a clear inverse correlation between log(RT) and log(SW). But once a wellindex color scale was applied (FIG 9), it appeared that what seemed like a valid cloud was in fact the combination of much narrower clouds, one for each well. It lead to realize that slightly different values were used on each well for the constants in Archie equation. Further review showed that there was no valid reason for this. The petrophysicist ended up editing the parameters and corrected SW was provided. Had it not been cleaned, it could have been incorrectly interpreted as lateral change of SW from well to well which could have been managed by local geostatitics.

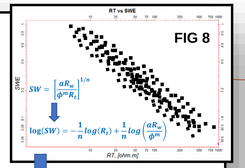

FIG 8

$$SW = \left[\frac{aR_w}{\phi^m R_t}\right]^{1/n}$$

$$\log(SW) = -\frac{1}{n}\log(R_t) + \frac{1}{n}\log\left(\frac{aR_w}{\phi^m}\right)$$

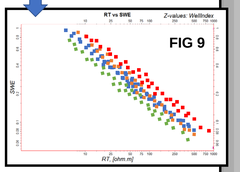

FIG 9

FIG 10 to 12 illustrates further the need to adjust to our colleagues' background in the context of collaborating with them in their part of the work. On a different project, the author worked on what was thought to be a pure limestone reservoir. Nevertheless, a neutron vs density porosity cross-plot seemed to show the presence of dolomite too (FIG 10). It looked similar to what is found in such plot in the literature (FIG 11). Using powerpoint, the author recombined artificially the plot from the geomodeling package with the theoretical plot (FIG 11). The final plot (FIG 12) reproduced a type of display the petrophysicist and the geologist were extremely familiar with. It simplified the communication with them and made it easier to to convince them that their understanding of the reservoir was incomplete, dolomite was present too and needed to be mapped.

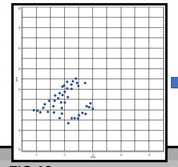

FIG 10

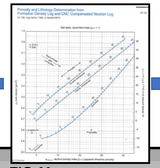

FIG 11

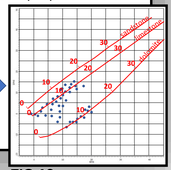

FIG 12

5. CONCLUSION.

Give the same geomodelling tools and the same dataset to two teams. The one mastering project management and team work skills will be most likely to build a better geomodel, with better integration of all the data and more suited to answer the team's questions about the reservoir. With that said, this is up to each of us, geomodeler, to be willing to improve in that domain. To the author, it means improving our communication skills. We must be humble enough to learn of others strengths and habits of work so that we can adapt how we present, not only our results, but also how we decide on the processes used to build our geomodels. Often, the adjustments we will need to do will seem minors. And yet, they can have tremendous impact on our results. All it takes to start this process is to discuss with our colleagues on how they would really like to work with us. Just don't be afraid of challenging the routine your team is currently settled in!

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