

## The art of collaboration

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Recently, one of our explorationists called me to his office the day before *the big meeting* and said, “Pat, the gravity doesn’t work over here!” I quickly checked with the gravity data (I needed to be positive before I spoke), and concluded that the gravity data and model were fine. I asked the interpreter “if we could possibly put more salt here?” because that seemed a viable interpretation that accommodated both the seismic and gravity data.

Many of you are familiar with the mammoth (sometimes 9 × 7 ft), face-only portraits by contemporary artist Chuck Close. He collaborates with master printmakers, stretching the limits of printer size and challenging technical complexity. The March 2004 issue of *Art in America* contains a story about Close’s collaboration with venerated Japanese woodcut master Tadashi Toda. When Close arrived in Japan to work on the piece, he was “not entirely pleased” that Toda was already well along. Here is Close’s rendition of his subsequent encounter with Toda which had to be filtered by a translator:

Tell him it is too green. [The translator] started talking and talking and there was an intense reaction from Mr. Toda. Finally I asked, “Why is it taking so long?” [The translator] said, “You don’t understand, what I have to say is ‘Chuck is thrilled with what you have done, he thinks you are a genius. He thinks it is perfection. Beyond his wildest dreams. Nothing could be done to improve it. However, in the interest of intellectual curiosity, not that it would be better than what you have done, just to see what would happen, could you possibly make it a little less green?’” We had to go through this every time. I needed to be positive about any correction I wanted to make. I found it strange yet interesting to let someone interpret the work, to make decisions about color and separations. I realized we had to work together to get a good print.

This reminded me of my job. Oil companies commonly turn 3D gravity and magnetic modeling over to “master” modelers. Full of confidence and ready to please, the masters take the top and base of salt surfaces offered from seismic interpretation, combine them with bathymetry, magnetic basement and Moho surfaces, and turn them into a well organized combination of grids and rock properties. The result is a look at the density distribution of the rocks in the subsurface as constrained by gravity, magnetic, and seismic data. After modeling, the surfaces are sent back to the oil company. They are loaded into the seismic project and integration begins.

*This process is fragile!* Not so much in terms of the geophysics—the modeling is fairly straightforward as long as you are careful. The more sensitive part is the collaboration. It is my contention that gravity modeling without a tight integration with the seismic interpreter is only an exercise in modeling. The benefit is in the information that the seismic interpreter gains from multiple rock properties to test and refine their interpretations. The goals are better seismic imaging and better drilling decisions.

Our seismic interpreters are experienced and are very knowledgeable about their seismic data and the associated

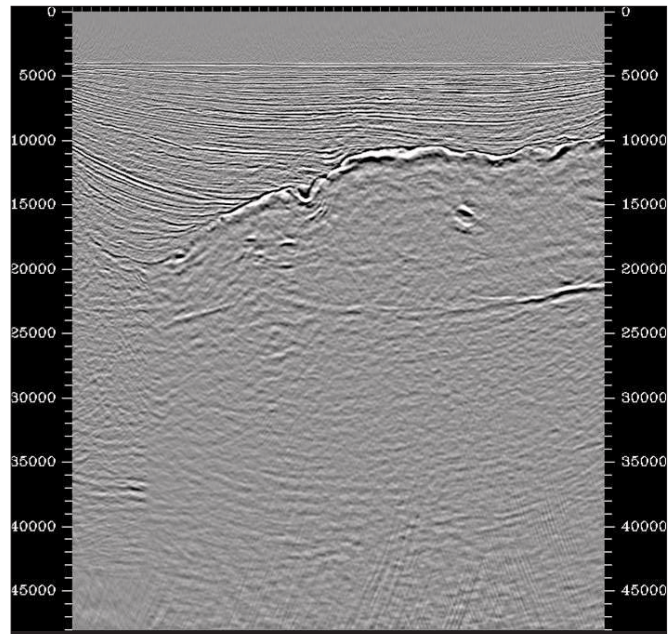


Figure 1. Uninterpreted seismic.

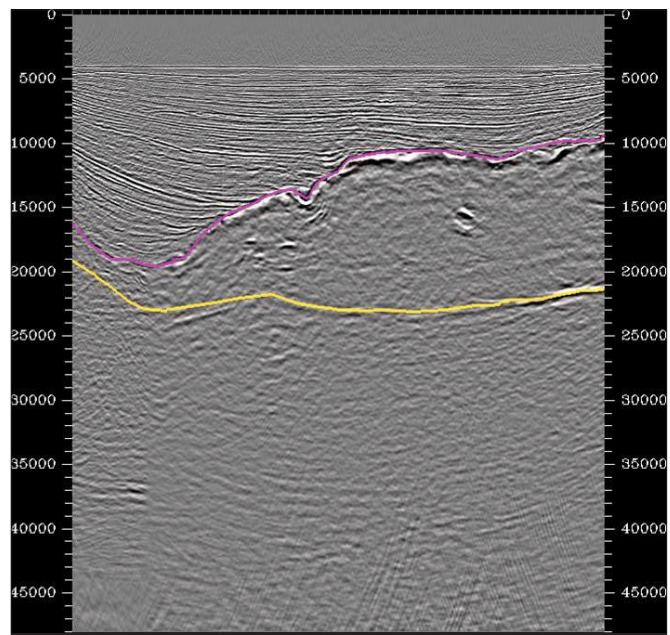


Figure 2. Original top (pink) and base (yellow) of salt interpretation from seismic.

geology. In a visualization center, with amazing wall-sized displays, we look at seismic lines or volumes. On display are the seismic horizons and the surfaces input and output from the gravity modeling. I learned long ago that I should not say, “Couldn’t you have picked that horizon another way?” which is our equivalent to Chuck Close’s “It’s too green.” Close’s story makes me laugh because it is very similar to the friendly, cautious approach we all take to ques-

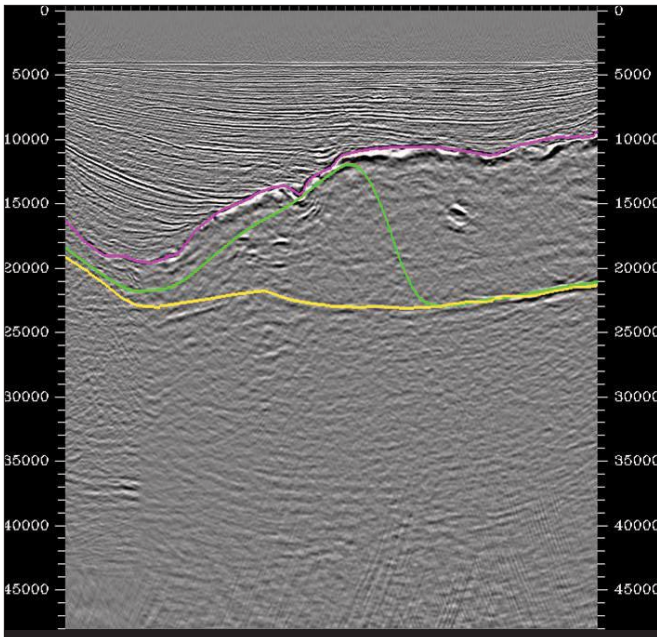


Figure 3. Green horizon is gravity-derived base of salt, suggesting much less salt than originally interpreted.

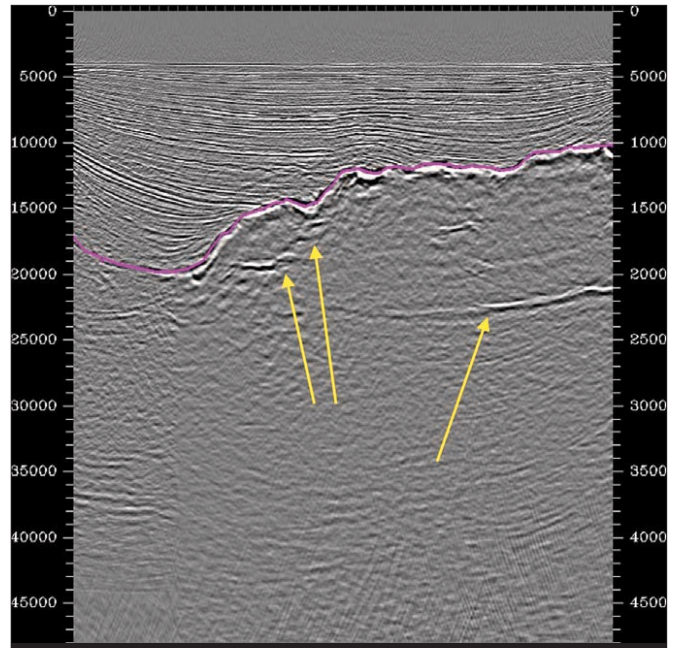


Figure 5. Look back at the seismic data; a parallel line shows similar clues to an alternative seismic interpretation.

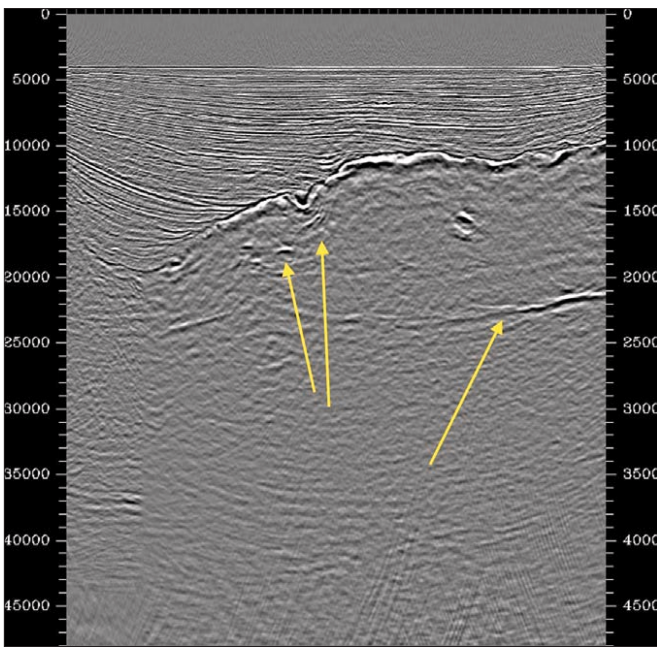


Figure 4. Look back at the seismic data; yellow arrows show clues to an alternative seismic interpretation.

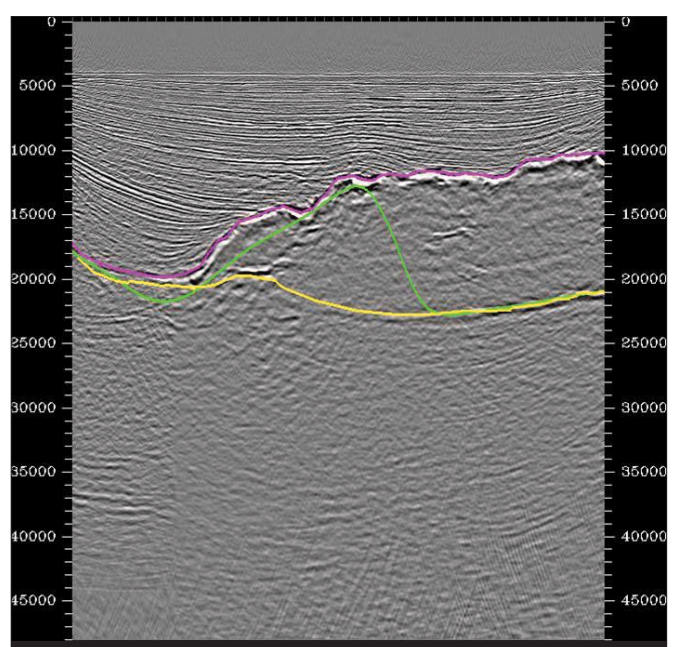


Figure 6. Gravity result for this parallel line.

tion each other's interpretations. And questions are always valid in geophysics, whatever the discipline.

I refuse to dwell on the perceived warts and limitations of gravity interpretation. I do not need to, since I am reminded daily by well-intentioned geoscientists who seem to have learned one thing very well from their gravity/magnetics course in college. But after almost 30 years working with the tools, I am able to show them that gravity and magnetics become quite strong when carefully combined with seismic data. It is my job to ensure good gravity and magnetic geophysics, just as I depend on the expertise of the seismic interpreter, project geologist, petrophysicist and modeling consultant. We need to respect each other and, in the end, respect all available geophysical and geologic data, or at least acknowledge that geophysical mismatches inher-

ently provide information and they require one to consider that the geologic model may be incomplete.

Another day not long ago, one of our explorationists saw me and our modeling contractor in the hallway. He said, "I need to ask you something. Take a look at this." There was a mismatch between his seismic interpretation and the gravity model. He went on to suggest (paraphrased), "I'm thrilled with what you have done, I think you guys are geniuses. I think your model is perfection. Beyond my wildest dreams. Nothing could be done to improve it. However—could you possibly check the gravity data and the model and see if this is correct?" (Figures 1-3). We did check. At the same time, the seismic interpreter looked at his data in a different way (Figures 4-6). Could the gravity data and the resulting model be correct? He looked at some parallel lines (Figures 5-6). "[He] needed to be positive about any correction." We determined

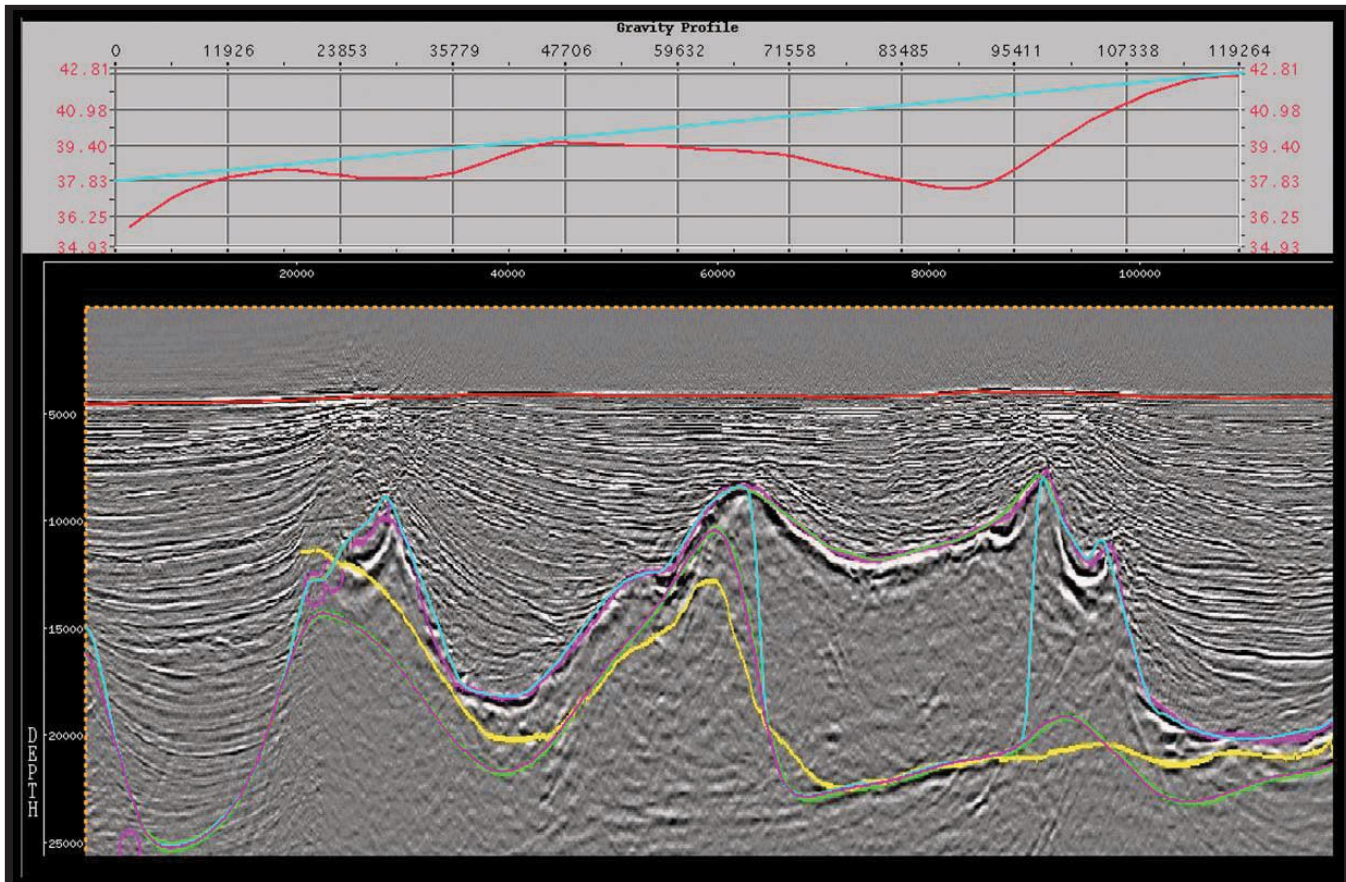


Figure 7. Critical look back at the gravity data reveals indications of the position, the center of mass, and the amount of salt.

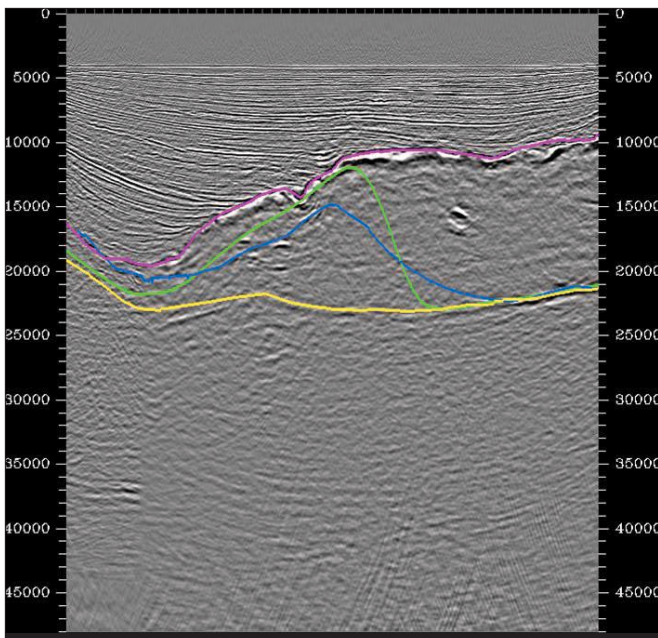


Figure 8. The yellow horizon is the original seismic base of salt. The green horizon is the gravity inversion result. The blue horizon is a modified seismic base of salt interpretation, using the gravity result as a guide.

the model was responding to the gravity field appropriately (Figure 7). The seismic interpretation was changed. It is not an interpretation that absolutely follows the gravity, but it is a more geophysically robust interpretation using the gravity/density information as a helpful guide (Figure 8).

Like any relationship, these collaborations require patience and respect. While it can be difficult “yet interesting to let someone else interpret the work” out-of-house, in the case of out-sourcing, the value of skilled professionals working efficiently with their best tools has been proven. The teamwork that is required in-house to integrate these data has also proven its value. There is an art to working together for a better result, and for a better understanding of earth’s complex geology.

**Suggested viewing.** Examples of Chuck Close’s work: [http://www.artcyclopedia.com/artists/close\\_chuck.html](http://www.artcyclopedia.com/artists/close_chuck.html) . **TJE**

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