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Another Bridge between Seismic and Geology : Uses of Geological Multi-Substack Inversion

Main data in exploration are well logs (confident high resolution image of the reservoir, but in one dimension at one location) and seismic volumes (do not provide us with geology but with impedance contrasts). By combining seismic substacks and logs (GammaRay), it is possible to generate "seismic" cubes (Pseudo-GR), in which each trace is a "log" with seismic resolution (unfortunately the log resolution is not yet within reach)!

In deep-water, at favorable depths, good quality seismic preserved amplitude data can let us think that sands are confidently imaged. But even in these conditions, seismic amplitudes (acoustic impedance) do not always highlight sands. With Pseudo-Blocs, in most cases, reservoir imaging is improved. Figure 1 shows an example of compared amplitude maps from a full stack seismic cube and from a "Pseudo-GR" bloc (PGR); Figure 2 shows corresponding vertical sections.

Apparently small differences can be observed on amplitude maps of Figure 1. But when analyzing vertical sections on Figure 2, large differences appear. The blue dashed line is HC-Water contact, controlled by WELL A (a few hundred feet to the North). PGR highlights oil sands in circle 2 (HC-W contact clearly visible) that are not that obvious on the full-stack data. In full-stack seismic, only a long and difficult analysis of sedimentary morphologies would have led to the same conclusion.

Pseudo-Blocs help making interpretation process easier and quicker, and also give more confidence in the net pay prediction, by directly highlighting the sand content in a 3D volume.