



# Exploring deeper in Uruguay:

## Could Namibia's successful Cretaceous play be chased in Uruguay's deepwater?

Recent discoveries in Namibia's Orange Basin have raised industry expectations that a similar level of success could be replicated in its conjugate margin, Uruguay. Still considered as a frontier basin, the Uruguay deepwater has similar geological elements at basin scale and unique aspects at prospect scale that could help to achieve exploration success at Cretaceous stratigraphic

levels. However, for Uruguay to become the next South American hotspot, a deeper understanding of its geological peculiarities is required. Viridien is currently conducting a 3D reimaging program that is applying its latest advanced imaging technologies, including Time-Lag Full-Waveform Inversion, to reduce geological uncertainties within Uruguay's deeper stratigraphy.

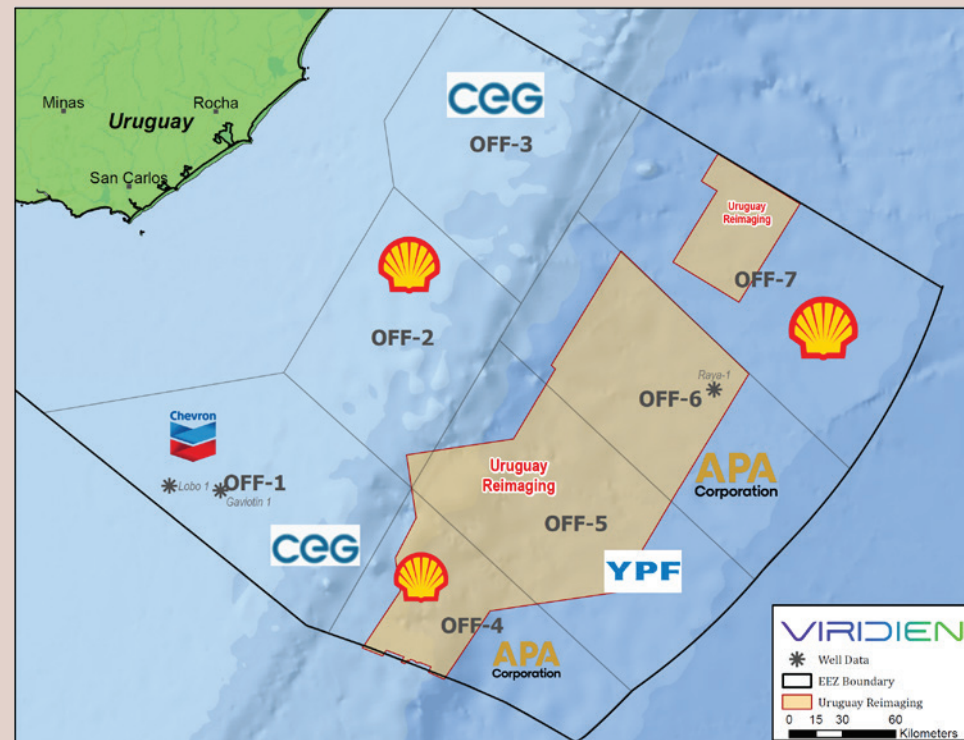


Figure 1. Location and coverage map of Viridien's 3D seismic reimaging program offshore Uruguay.

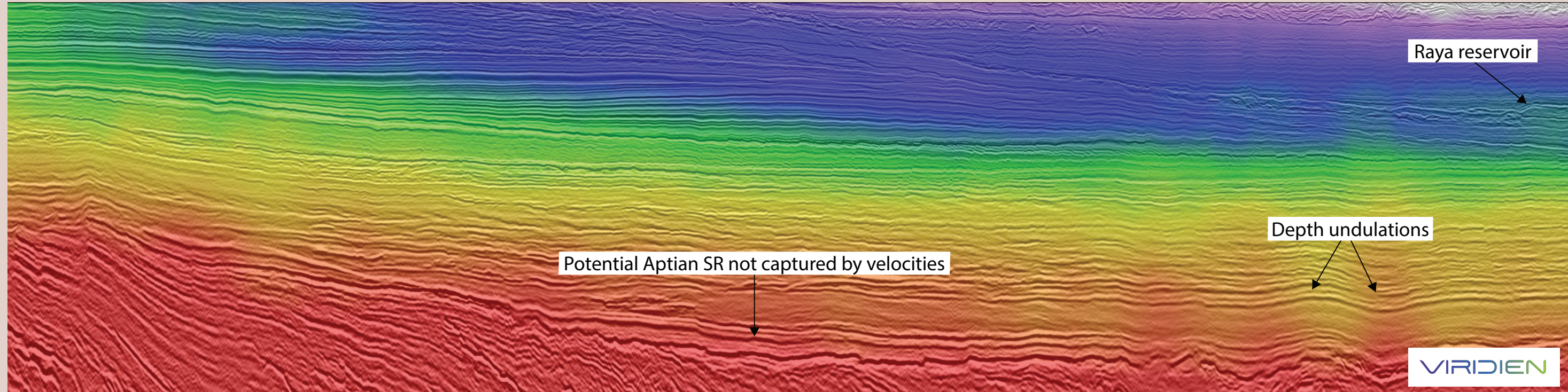


Figure 2A. Legacy imaging product.

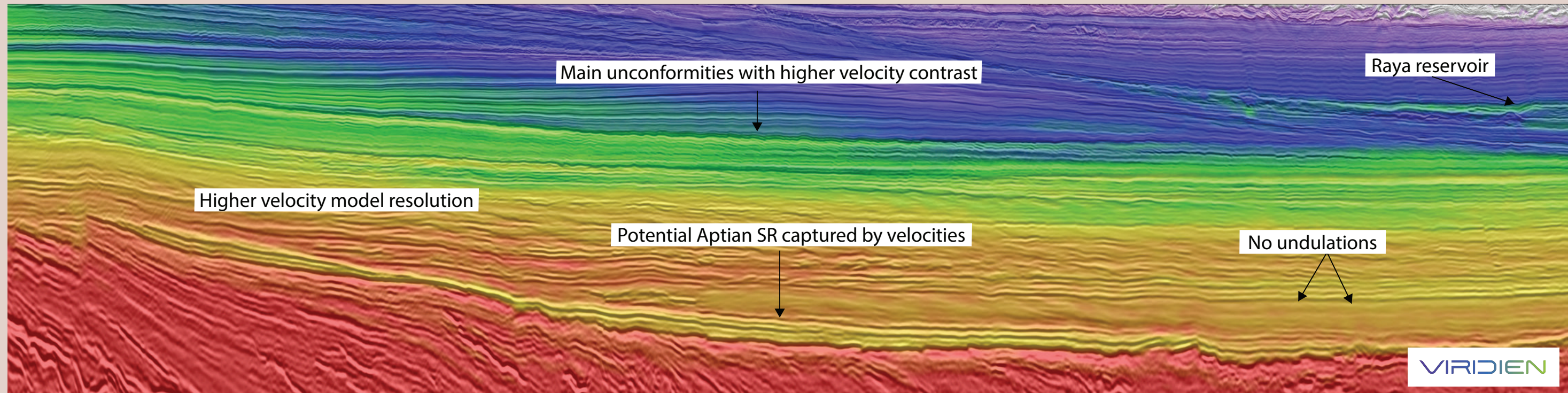


Figure 2B. Viridien's TL-FWI reimaging product.

# Deepwater Uruguay: Reducing uncertainties in the Cretaceous stratigraphic play with an improved TL-FWI velocity model

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## FWI VELOCITY MODEL UPLIFT

The advancement in Full-Waveform Inversion (FWI), both in efficiency and quality, has been phenomenal, especially since the introduction of Time-Lag Full-Waveform Inversion (TL-FWI) in 2018, which has led to data reimagining opportunities aimed at achieving more accurate velocity models and improved seismic images. In May 2023, Viridien launched a 25,000 km<sup>2</sup> reimagining program for all non-multi-client data offshore Uruguay. Reimagining of two priority sub-regions (OFF-6 and 7) was completed in May 2024, and the remaining two sub-regions (OFF-4 and 5) are expected to be completed by the end of this year. Figure 2 shows a dip line comparison between legacy imaging and Viridien's new reimagining. As expected, the velocity model from the reimagining program is more geologically sound, revealing previously unseen details of interest to exploration geologists and reducing uncertainties on low-relief stratigraphic traps.

## EXPLORATION HISTORY

The Uruguayan Continental Margin has been briefly tested by only three wells: Lobo x-1 and Gaviotin x-1 (1976) and, most recently, Raya x-1 (2016).

Raya x-1 confirmed the presence of good Miocene / Eocene sandstone reservoir intervals (135 m thick and 24 % porosity). However, the underlying Paleocene appears clay-marl dominated with continuous parallel seismic facies with no visible faults to enable hydrocarbon migration from a potential deeper Aptian source rock as seen across the conjugate margin of Orange Basin, Namibia. This scenario naturally steers future exploration in Uruguay to target deeper reservoirs at Cretaceous levels. Reimagining in depth will further help to eliminate charge-migration risk and to pursue and test Namibia's play equivalents in deepwater Uruguay.

## MITIGATING RISKS OF A CRETACEOUS PETROLEUM SYSTEM

**Source Rock:** Exploration in Namibia's Orange Basin has proven a prolific world-class source rock of Aptian age deposited on top of seaward dipping reflectors (SDRs)(Figure 3). The soft-top, tabular geometry of this key source rock horizon can be clearly identified in the newly reimagined 3D seismic data in the lesser explored conjugate Uruguayan Margin. Viridien's new TL-FWI data-driven velocity model played a key role in risk reduction relating to source

rock presence by increasing the vertical resolution of the velocity model and removing depth undulating artifacts. Notably, it highlighted three key velocity reversals: one in the lower Cretaceous sequence (likely of Barremian age), another in the Aptian sequence, and a third associated with a potential Cenomanian-Turonian source rock interval (Figure 2b).

Uncertainties regarding Aptian source rock maturity can also be mitigated. Viridien's basin modelling studies indicate that postulated Aptian Source Rocks reached maturities ranging from oil mature to gas mature across the basin in Uruguay.

The thicker overburden in parts of the Uruguayan margin also brings into play the Albian and Ceno-Turonian (A-CT) source rocks which are immature in Namibia. If the A-CT source rock is considered in the South American case, then Uruguay could offer multiple petroleum systems to charge prospective reservoirs.

**Reservoir:** Risk of reservoir presence is expected to be low in the Cretaceous offshore Uruguay. Just as in Namibia's successful case, many channel / fan systems can also be identified in Upper, Mid and Lower Cretaceous levels in Uruguay in all the offshore blocks OFF-4, OFF-5, OFF-6 and OFF-7. Envelope attributes extracted at multiple levels in Viridien's newly reimagined 3D seismic data shows the scale and variable distribution of Cretaceous channels and fans (Figures 4a, 4b and 4c) indicating many promising targets. The Late Cretaceous seems particularly prospective based on its burial depth, lying in a good drilling range and likely to have retained good reservoir quality.

Viridien's 3D reimagining of deepwater Uruguay has revealed the promising prospectivity of an under-explored basin along the Atlantic margin.

This extensive data set, coupled with key learnings

taken from successful exploration in the Orange Basin of Namibia, gives an insight into the key geological uncertainties in terms of source rocks and reservoir presence, and serves as an invaluable tool to future explorers for decision-making and exploration risk reduction in this highly prospective basin.

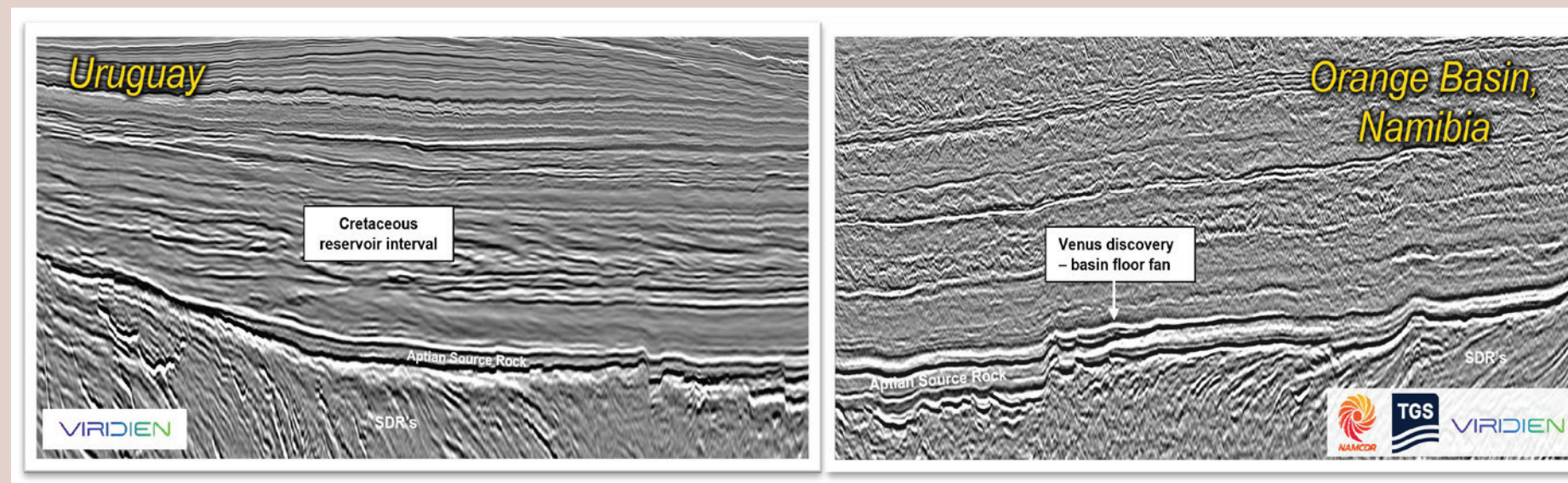


Figure 3. A comparison between the conjugate margin of Uruguay (left) using newly completed 2024 3D PSDM reimagining and Orange Basin, Namibia (right) using 2D PSTM (2018) reimagining, highlighting similarities across the margin in terms of structural evolution, basin geology and hydrocarbon potential.

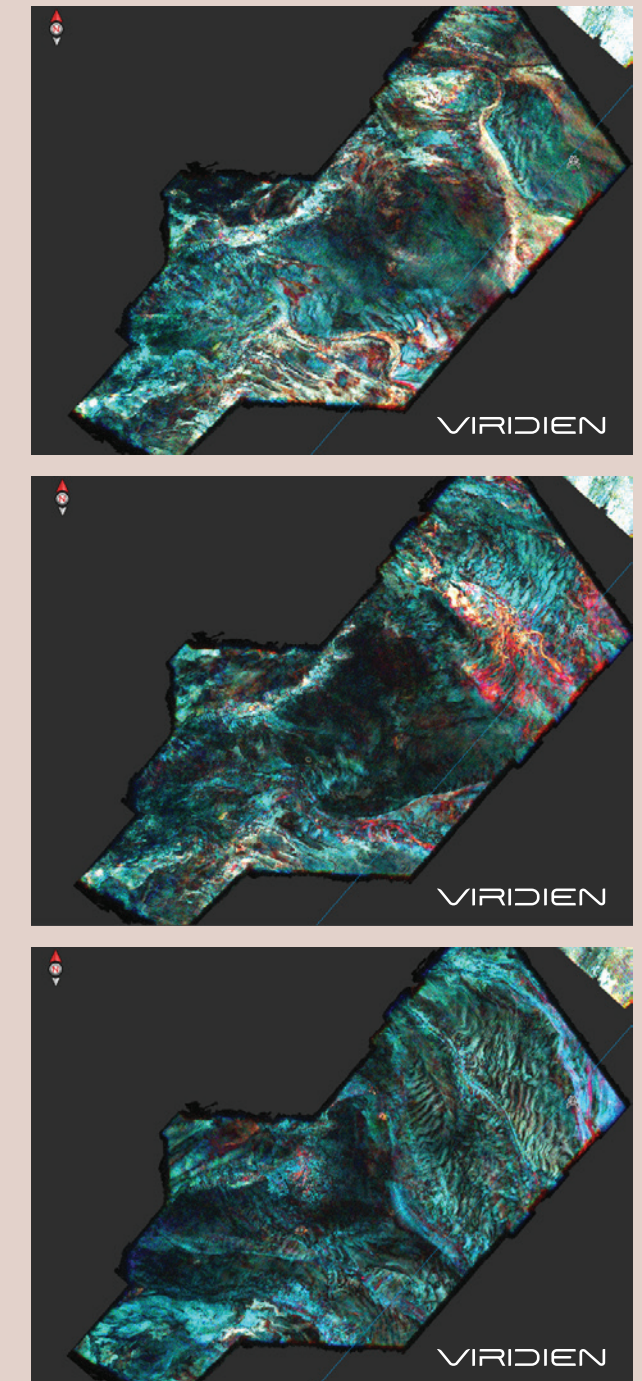


Figure 4. RGB colour blend of Angle Stack Envelope extractions from three horizons indicative of reservoir presence through the Cretaceous section in Uruguay based on Viridien's new 3D seismic data set (Red = UFar, Green = Mid, Blue = Near).