

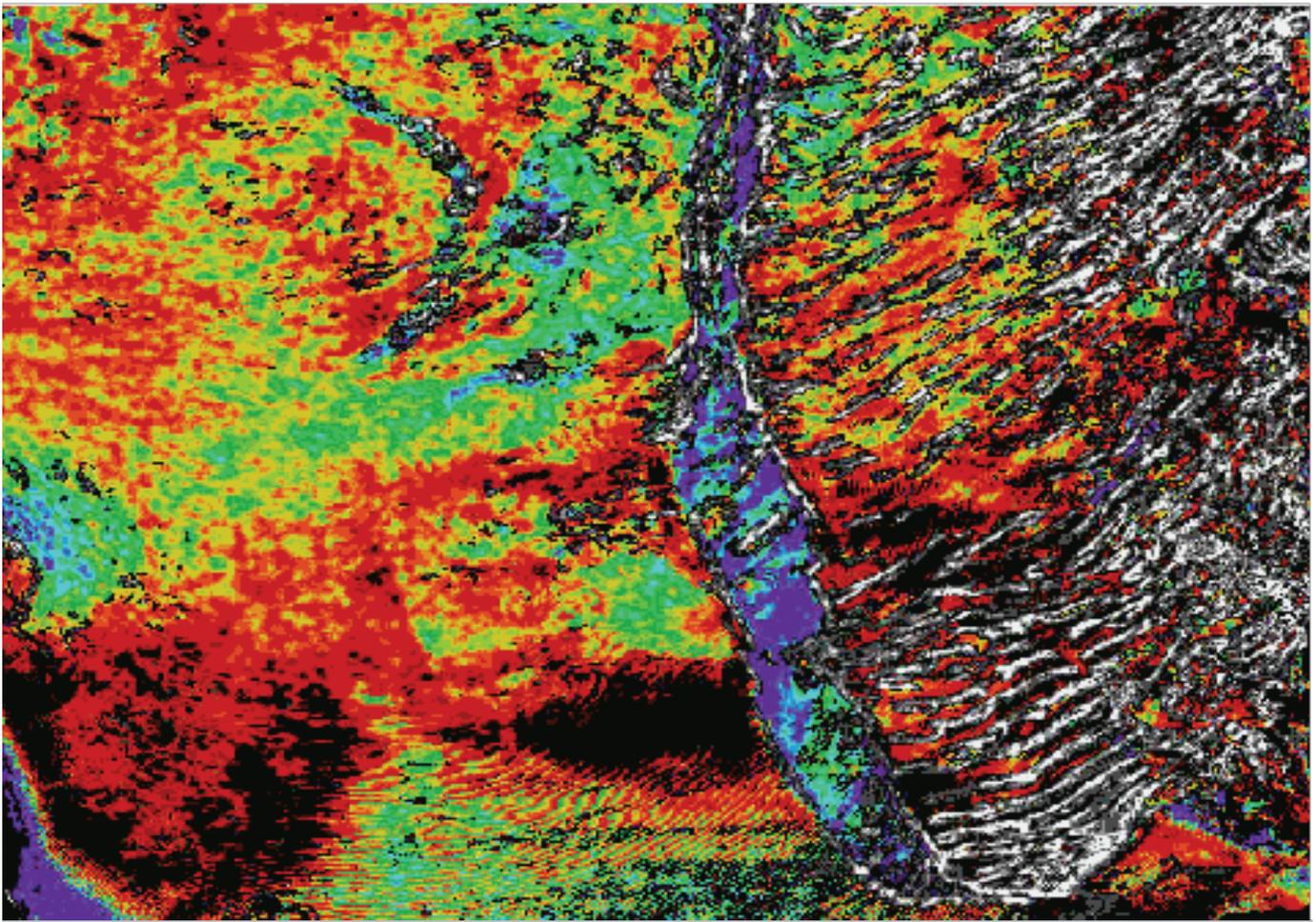
Geohazard Detection by Seismic Facies Classification

The Challenge

An independent oil company working in Gulf of Mexico deepwater needed to reduce their drilling risks in the presence of geohazards. Knowing that operators have experienced catastrophic loss of drilling equipment, severe injury to staff and pollution in incidents associated with loss of well control, they wanted to perform an exhaustive analysis of existing data to mitigate as much as possible the drilling risks associated to geohazards.

The Assessment

Known geohazards in the Gulf of Mexico include shallow water flow sands, shallow gas pockets and hydrate zones and can significantly affect drilling budgets. Predicting geohazard locations proved difficult and inexact using conventional interpretation techniques. If drillers encounter unanticipated, non-consolidated sands, serious problems could arise, and the well may even need to be re-drilled. However, when done prior to drilling, proper examination of the near seabed can save time and money while improving safety.



▲ View of Gulf of Mexico geohazards indicating shallow water flow sands, shallow gas pockets and hydrate zones.

The Solution

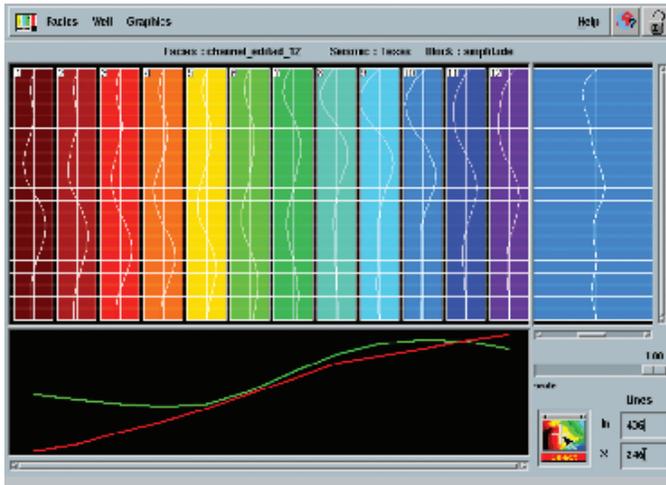
By classifying each seismic trace within a selected interval, Paradigm Stratimagic® is able to derive a spatial distribution of seismic facies based on the character of the seismic wave form. In this case, a seismic facies map was generated by a neural network applied to a short interval referenced to the seabed horizon.

The neural network initially generates a series of model traces which represent shape variations within the interval. The classification process then compares each seismic trace with the models and assigns it to one of the seismic facies classes, based on the best fit. This technique is known as unsupervised seismic facies analysis since it does not require any well data or prior knowledge of the geology.

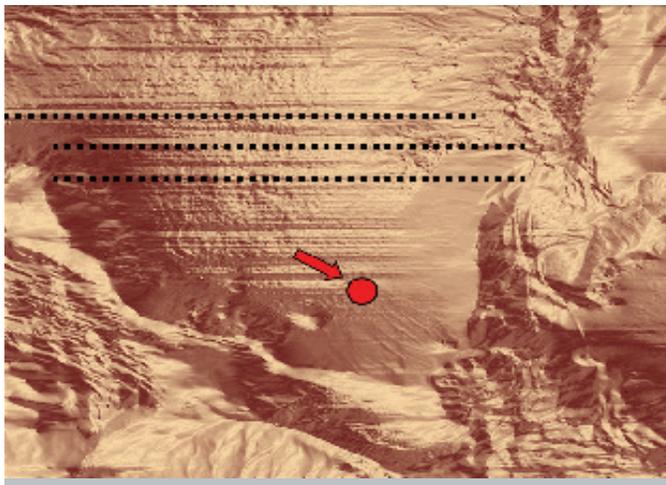
The resulting maps bear many similarities with airborne photography of modern depositional systems. The aerial distribution of colors indicate the location of traces having similar characteristics, and local anomalies with typical shapes, such as gas hydrate mounds, become quite visible and easy to identify. Most geohazards are identified by the trained eye of a geologist, based on the typical morphology of similar features on maps or aerial photographs.

The Results

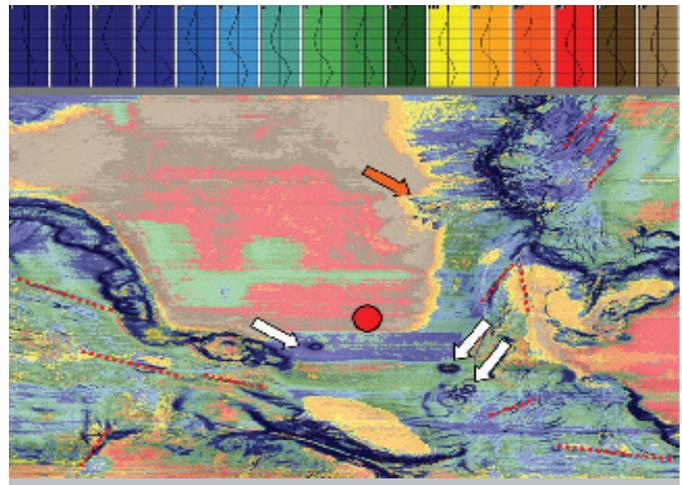
The interpreter was able to use a seismic facies map, where each color corresponds with a certain seismic shape, to visualize sea floor heterogeneities by revealing subtle geologic features only expressed in the shape of the seismic trace. The project confirmed that the proposed well would be drilled in a safe location away from shallow faults (red dashed line), debris flow (orange arrow) and gas-hydrate mounds (white arrows).



▲ Model wave form traces



▲ Map showing acquisition footprints (black dashed lines) over the sea floor topography. The proposed well location (red arrow) targets Pliocene oil-bearing sands at approximately 20,000 feet.



▲ Seismic Facies Map: well location (red dot) avoids shallow faults (red dashed line), debris flow (orange arrow) and gas-hydrate mounds (white arrows).