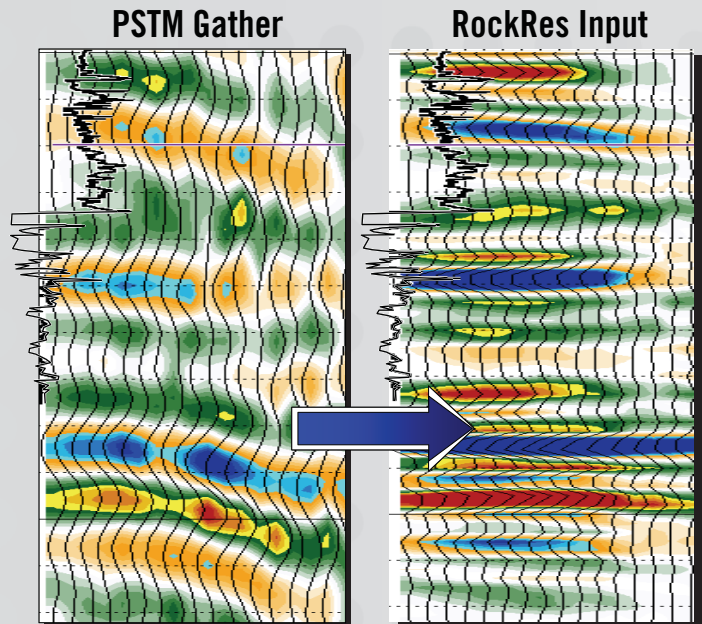
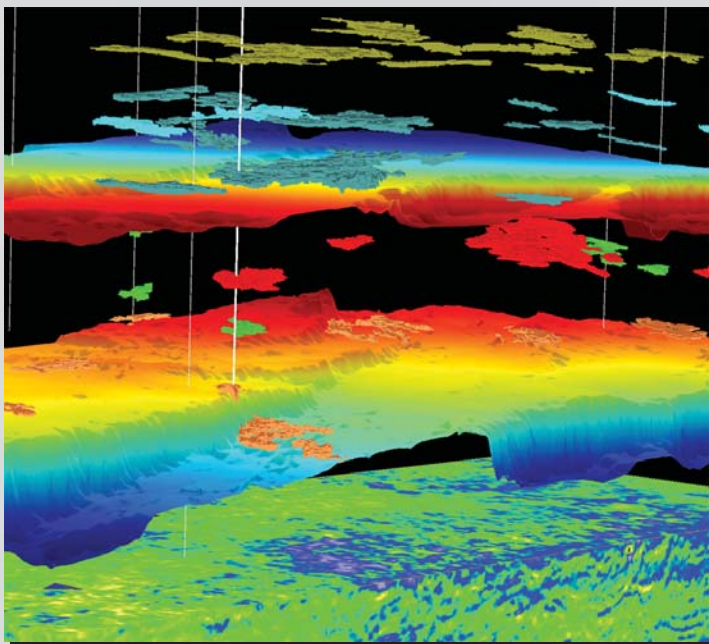


# RockRes®

Geotrace's RockRes® is a pre-stack seismic inversion to absolute rock properties. P-wave velocity, S-wave velocity and density reflectivity are derived from a three-term AVO inversion utilizing the Aki & Richards approximation to the full Zoeppritz equations. These are converted to interval attributes using broadband deterministic inversion while utilizing one of Geotrace's several options for bandwidth extension. Other rock properties are then derived including shear modulus, Young's modulus, Poisson's ratio and bulk modulus.



The best algorithms for multiple attenuation, residual moveout, noise removal and bandwidth extension are applied for input.



This image is from a RockRes® in Breton Sound, offshore Louisiana\*. Geobodies correspond to the zones with the best possibility of good sand quality and high-saturation hydrocarbons.

\*Data owned or controlled by Seismic Exchange, Inc., analysis performed for Cs Solutions, Inc.

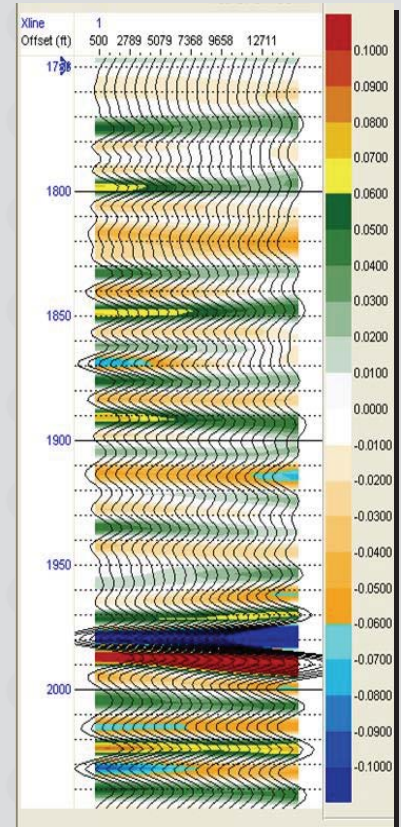
Why go to all this time and trouble? When these properties are known, both lithology and fluid characteristics for the potential reservoir can be estimated. You can know before drilling what the reservoir type is, its porosity and, very often, fluid type including gas saturation. This is risk reduction at its best.

RockRes® is very seismic-driven, wells being used primarily for phase control and calibration. Therefore it can be used both in exploration and development settings with little well or good well control.

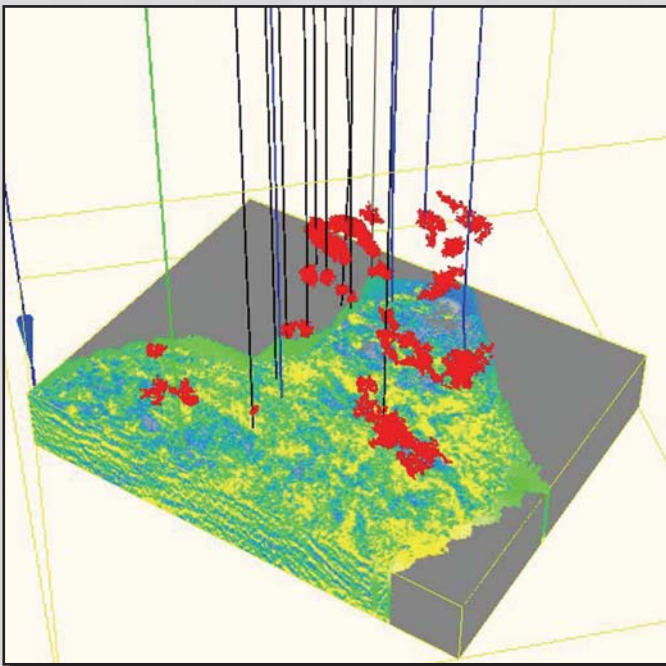
# Where does RockRes® work?

Over the last several years RockRes® has been performed in plays all over the world; onshore, offshore and in transition zones. Reservoirs have ranged from low impedance sandstones in the Gulf of Mexico to tight sands in the Nile Delta, and from limestones with dolomitic porosity to those with fractures. Shale resource plays have also benefited from this technology.

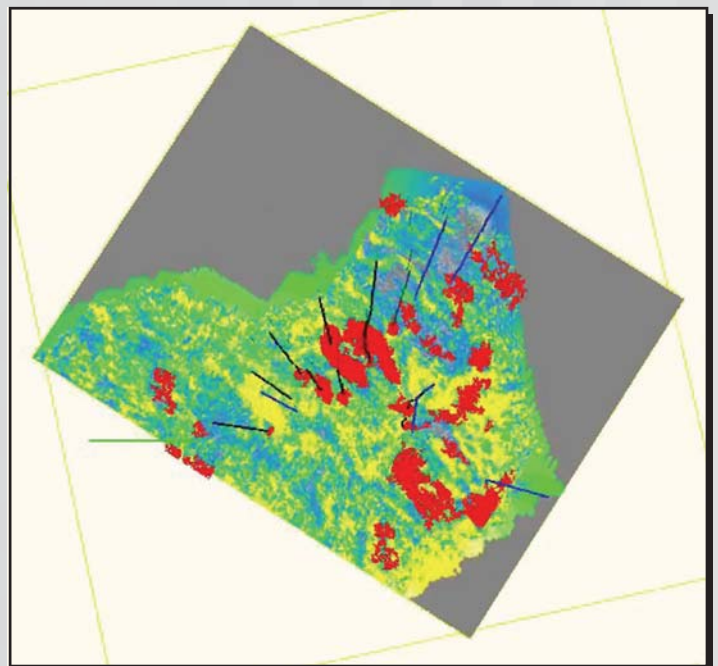
**Results:** Oil and gas companies have seen significant risk reduction using RockRes®. In almost all cases the lithology has been properly predicted as well as the fluid content. This is true even in deep, tight, and thin sands in the Rocky Mountains, U.S., where the presence or absence of sand, the sand quality, and the fluid content (gas vs. water) were accurately predicted for all wells in the area from the inversion results. The inversion itself and then the interpretation of the rock properties using multi-attribute facies classification and visualization have shown to be invaluable where the use of stacked data or AVO analysis were not sufficient.



Forward model to help determine whether inversion to rock properties will be of help in an area.



This Southeast Texas example shows 16 wells drilled in a 30 mi<sup>2</sup> area, 12 of them producers. However, the last four wells drilled were wet and the question was whether there were any more drillable locations.



The geobody pay sands resulting from RockRes® inversion show at least eight more drillable locations while also demonstrating the absence of hydrocarbons in the wet wells.

