

Gravity and magnetic analyses can address various petroleum issues

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Gravity and magnetic data can be used in many ways to solve different exploration problems, depending on the geologic setting and rock parameters. Although most think of gravity and magnetics as tools to map structure, these data can be analyzed to provide insights to other elements of petroleum exploration and production. The table below describes some of the techniques that can be applied to address a wide variety of issues. The impact of all of these techniques increases if the gravity and magnetic analysis is integrated with other data and studies. \square

Issue	Gravity and magnetic tasks	Integrated with
<p><i>Source Rock Deposition</i></p> <ul style="list-style-type: none"> Where were the source rocks deposited? How deep are the source rocks? 	<p>Depth to magnetic basement Regional basin enhancements</p>	<p>Seismic data Regional geology</p>
<p><i>Source Maturation</i></p> <ul style="list-style-type: none"> Where are the "cooking pots" and fetch areas? What is the present-day heat influx into the basin and how much does it vary? What is the thickness of the crust? What is the overburden? 	<p>Depth to magnetic basement Isostatic residuals Sediment thickness Depth vs. density modeling Regional structural modeling Curie Point (regional heat flow) Delineation of volcanics</p>	<p>Seismic data Well data Density and velocity data Heat flow data</p>
<p><i>Hydrocarbon Migration</i></p> <ul style="list-style-type: none"> How much relief is there on the basement? What are the "shapes" of the "cooking pots"? Are there major vertical conduits near source areas? Are there major lineations and how do they relate with more recent geologic features? 	<p>Magnetic inversion Depth to magnetic basement Vertical fault identification Gradient analysis Regional depocenter and sediment path enhancements</p>	<p>Well and outcrop data Topography Remote sensing Seismic data Sequence stratigraphic analysis Seismicity</p>
<p><i>Reservoir Prediction</i></p> <ul style="list-style-type: none"> Where are the thickest sediments? Where is the highest sand probability? Where was the source of sedimentation? What is the influence of tectonics on deposition? Have the sediment depocenters shifted over time? What is the compaction history of the sediments? Do the sands have lateral continuity and connectivity? 	<p>Depocenter and sediment path enhancements Integrated basin modeling Density inversion Provenance (magnetic lithology) determination Sedimentary magnetic analysis Paleomagnetic analysis Integrated velocity analysis (2-D and 3-D)</p>	<p>Seismic data Lithologic data (outcrop and well) Sequence stratigraphic analysis Biostratigraphic data</p>
<p><i>Trap</i></p> <ul style="list-style-type: none"> Where are the major structures? What is the structural grain? Are there faults in the sedimentary section? Are there lateral porosity changes? 	<p>Residuals and enhancements 2-D/3-D structural/stratigraphic modeling Fault identification — gradient analysis Structural inversion Density inversion</p>	<p>Seismic data Outcrop information Topography Remote sensing Seismicity</p>
<p><i>Vertical Seal</i></p> <ul style="list-style-type: none"> Where are salt overhangs? How thick is tabular salt? How thick are volcanics? 	<p>Residuals and enhancements Layer stripping Integrated 2-D/3-D modeling, Sedimentary magnetic analysis</p>	<p>Seismic data Sequence stratigraphic analysis</p>
<p><i>Timing</i></p> <ul style="list-style-type: none"> What are the ages of sedimentary features? How do all of the petroleum system elements fit together and what is the timing? 	<p>Integrated 2 1/2-D structural/ stratigraphic modeling Layer stripping and enhancements Tectonostratigraphic analysis Paleomagnetic analysis</p>	<p>Density, and velocity data Seismic data Biostratigraphic data Back-stripping Palinspastic reconstructions</p>