Heat Flow has a decisive influence on the generation of hydrocarbons in sedimentary basins. Heat flow data provide key insights into hydrocarbon maturation by constraining basin evolution models, defining oil and gas thermal windows, and determining thermal conditions prior to drilling. A well-developed understanding of present and past thermal states is critical to evaluating exploration risk.

Seafloor heat flow can vary significantly across small distances due to a variety of geological and environmental factors. Heat flowing through sedimentary rocks drives the chemical reactions that transform organic matter into petroleum. Although the global heat flow dataset demonstrates a correlation with tectonic plate age, individual ocean basins have unique tectonic, sedimentation, and thermal (i.e. heat flow) histories that often deviate significantly from global averages.

Low-quality or imprecise heat flow data may lead to erroneous inferences of hydrocarbon potential.

UNDERSTANDING HEAT FLOW

Understanding the mechanisms of thermal transport within a regional hydrogeological and geochemical context is difficult, but essential in a scientific approach to petroleum exploration. To help clients understand heat flow and clearly define thermal objectives, we design surveys incorporating precision targeting that account for:

- Conductive thermal refraction
- Advective heat extraction
- Sedimentation history and geomorphology
- Episodic changes in bottom water temp
OUR HEAT FLOW PROBE

Our standard, multipenetration violin bow heat flow system stems from designs pioneered and used by prominent academic research institutions. The design of the violin bow and strength lance provides both the mechanical robustness to withstand repeated insertions and withdrawals from the sediment, and the sensitivity needed to make high accuracy measurements. The ability to operate continuously for up to 24 hours in water depths up to 6,000 m makes our system highly adaptable to a wide variety of geothermal objectives.

DATA COLLECTION

Conductive heat flow at the seafloor is calculated as the product of the vertical thermal gradient and the sediment thermal conductivity. Our probe measures these two components in situ using high-accuracy thermistors with a resolution of 0.001°C, with multiple measurements being possible on any single lowering to the seafloor:
- Deployment/recovery very similar to coring operations
- Precision navigation using USBL
- Real-time data telemetry allows for measurement quality assurance and operational efficiency
- Thermal equilibrium achieved in 20 min

DATA PROCESSING & INTERPRETATION

Precise and accurate processing is critical to reduce the degree of uncertainty when thermal extrapolations are made below the seabed. We incorporate numerical models and processing algorithms developed at Los Alamos National Labs, the University of California Santa Cruz, the Pacific Geoscience Center, and the U.S. Academic Heat Flow Facility at Oregon State University to provide research-quality academic analysis. Our geostatistically robust datasets allow for determination of subtle thermal trends that can be integrated with geochemical, geophysical, and hydrogeological datasets and interpreted within a regional context.

High-quality measurements targeting specific thermal objectives ensure that basin evolution models are well constrained. Collection of data without a thorough understanding of the factors capable of generating anomalous values may lead to erroneous inferences about hydrocarbon potential and significantly affect assessments of exploration risk.

FUGRO’S HEAT FLOW DIFFERENCE

Who you have aboard matters. We meet with clients to determine their individual thermal objectives, perform extensive hydrogeological, geophysical, and thermal background research, design surveys intelligently, and send recognised experts into the field to collect, process, and interpret the data aboard the vessel. By executing an integrated heat flow survey, specifically designed to yield scientifically-valid results, present-day heat flow values provide powerful modeling constraints for unravelling basin thermal (and hydrocarbon) evolution.

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