






CATALOG OF SERVICES



SERVICES SUMMARY

Geoscience Services <i>Field Geoscience Services</i> <i>Office/Lab based Geoscience Services</i> 	<ul style="list-style-type: none"> • Wellsite Supervision • Mudlogging • Coring Supervision • Field Geochemistry <ul style="list-style-type: none"> • Reservoir Evaluation • Basin Analysis • Geochemistry • Remote Geosteering • Petrography • Operations Geology
Geosteering Services 	<ul style="list-style-type: none"> • Remote Geosteering • Onsite Geosteering • Remote Directional Drilling • Combined Services
Drilling and Completions Services 	<ul style="list-style-type: none"> • Drilling Optimization • Abandonment Studies • International Consulting • Lab Services • Equipment Rentals • Staffing & Project Management

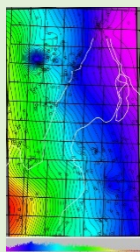
GEOLOGICAL WELLSITE SUPERVISION

Cuttings sample preparation, description, logging, interpretation - Directional drilling and MWD supervision - Mudlogging and gas detection supervision - Special geological operations supervision - Client liaison and reporting		
Petrographic analyses of drill cuttings 	<ul style="list-style-type: none"> • Preparation: wash, vial and label dry cuttings samples, index for subsequent analyses • Description: petrographic descriptions of samples: Primary lithology, main constituents, grain size, cementation (type and degree), accessory minerals, porosity type, fluorescence and fluorescent cut description • Logging: Drafting of striplogs, directional surveys, mud data, bit data, engineering comments, etc. • In addition to petrographic descriptions of drill cuttings, striplogs include presentation of drilling curves (geology and drilling curves, chromatography, wireline logging), directional surveys, mud data, bit data, engineering comments, etc. we use consistent, easy-to-read-layouts, with comprehensive details 	
Directional drilling supervision 	<ul style="list-style-type: none"> • Plotting actual well path against designed well trajectory on directional charts • Identification of wellpath relative to stratigraphic markers (wellpath with TVD gamma and formation tops) and constant communication with directional drillers to ensure wellpath follows optimal trajectory • MWD/LWD supervision: data stream monitoring and transmission to parties 	
Chromatography Services	<ul style="list-style-type: none"> • Chromatography curves plotted into composite logs • Ratio analyses in real-time • Geosteering / reservoir navigation aided by gas ratios • Gas shows logging (gas show tally) and interpretation (formation gas vs produced gas) 	
Special geological operations supervision	<ul style="list-style-type: none"> • DST supervision • Coring supervision • Wireline logging supervision • Special sampling (IsoTubes, Geo-jars, XRD/XRF, etc.) 	
		

RESERVOIR EVALUATION AND BASIN ANALYSIS

Chinook provides a broad range of basin analysis, reservoir evaluation and prospect generation. Built on 50 years of knowledge and expertise, Chinook offers best-in-class information solutions in order to make the most informed capital investment decision.

Basin Analysis

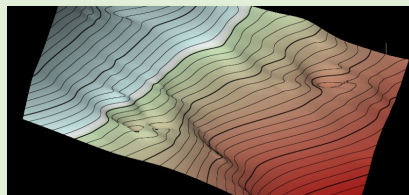


- Our team provides basin and play analytic geoscience studies for Canadian, US and International basins
- Key Horizon GG&E interpretation with grids as required
- Integration of key play data, petrophysical, geophysical, mineralogy, petrology
- EUR and cost analysis
- Regional analysis of development and exploration upside identification
- Statistical relationship of technical and financial performance

Log Analysis and Reservoir Characterization

- Petrophysical log Analysis and interpretation
- Integration of conventional MWD log data and special core analysis
- Model integration of mud log, core and cuttings data
- Petrophysical calculations including Vsh, SW, Porosity
- Permeability, lithology, TOC, elasticity facies

Prospect Generation



- Identification of opportunities and bypassed pay
- Uncertainty assessment, risk vs opportunity
- Reservoir Engineering
- Field Development and well planning

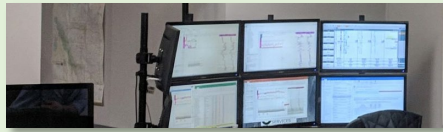
Reservoir Evaluation

- Building integrated geological model
- Porosity and saturation estimation
- Reservoir quality evaluation
- Geological Support for Corporate and property Evaluation
- Geological Support for Abandonment studies

GEOSTEERING

Continuous supervision of drilling operations, continuous assessment of the stratigraphic location of the drill bit in real time, correlation of drilling, MWD/LWD and mud gas parameters throughout the wellbore and against offsetting wells profiles, use of offset well information to optimally land the build section, utilizing TVD logs with cross plot of offset data, continuous monitoring and critical evaluation of the wellpath inclination and azimuth in relation to stratigraphic markers and porosity windows, continuous communication with directional driller to make proactive wellpath adjustments ensuring wellbore placement remains within the acceptable stratigraphic window, proactive evaluation of wellpath position in relation to existing and planned wellbores, reservoir navigation.

Remote Geosteering

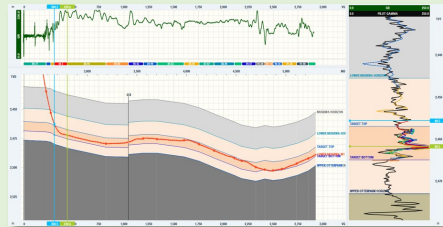


- In geosteering rooms set up at operator's premises or in Chinook's operations room
- Strat based or model based geosteering
- Optimize drilling, reservoir penetration and/or completions efficiency
- Correlations, look-ahead targeting, detecting trends

On-site Geosteering

- Performed in conjunction with wellsite geology or mudlogging

Remote Directional Drilling



- Custom solutions can be tailored based on client and project specifics from our Remote Center or your Office
 - Well-planning and borehole trajectory optimization
 - Make unbiased recommendations for motor selection and settings during planning
 - Optimizes borehole trajectory during drilling using models in real-time
 - Running Borehole Cleaning and Hydraulics in real-time to reduce back-reaming and improve
- The service can be run in conjunction with Well Delivery Optimization and Drilling Performance Optimization services*

Combinations and variations

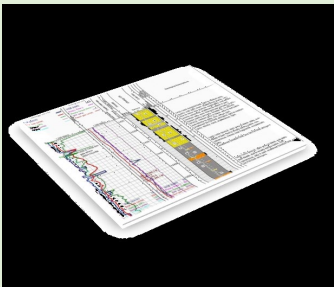
- Custom solutions can be tailored based on client and project specifics



PETROGRAPHIC STUDIES

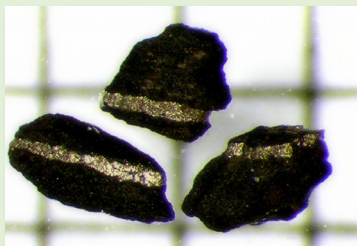
Chinook Consulting employs the services of several petrographers. Studies on cores and cuttings, as well as thin sections, can be performed on the client's premises, at laboratories, at the board or at our office.

Petrographic striplogs



- *By utilizing specific software with user defined templates created specifically for petrography all parameters and interpretations can be exported in digital form to be used in geological models*
- Petrographic descriptions of samples (main constituents, grain size, cementation, accessory minerals)
- Porosity and permeability estimation
- Oil staining, fluorescence and cut
- Fracturation
- Reservoir evaluation
- Digital microscope photos
- Digital data exports (las, csv, txt)
- Thin Section Petrographic Studies

Digital Photography



- High resolution photography of drill cuttings as seen through a microscope enable our petrographers to perform extremely accurate measurements of drill cuttings
- High resolution micro-photography
- Identification of petrographic features on images
- Grains, constituents, cement type, porous space, porosity type, fractures
- Direct measurements on calibrated images:
- Grain size, Pore size, Microfracture span, Overgrowth crystal size

Reservoir evaluation

- Porosity estimation (porosity type, percent estimation)
- Permeability estimation (Sneider classification, Archie classes) based on accurate grain size measurements and porosity estimates
- Identification of open and closed fractures, identification of fracture fill, measurements, frequency estimates
- Visual identification of oil stain, fluorescence and fluorescent cut
- Facies identification
- High grading and collection of samples for additional analysis (XRF, XRD, QRF, RockEval, SEM, TOC, etc.)

GEOCHEMISTRY

Geochemical analysis on cuttings samples or core, performed in the field while drilling or in our laboratory. Real time field analysis has applications in active geosteering; Laboratory examination (usually paired with petrographic analysis) sheds light on issues encountered with drilling or during completion and production.

XRD Analysis



- X-Ray Diffraction: Identify crystalline phases and orientation, clay speciation and mineral provenance
- Research family of diffractometers, Cu X-ray source combined with Vantec 500 detector provides fast and innovative x-ray diffraction (XRD2) solutions
- Powder X-ray diffractometer with ability to measure more than just powder but also bulk metals, fabricated parts, coatings, polymers, etc.
- Uniquely suited for rapid and accurate multipurpose modern materials research characterization.

XRF Analysis



- Preparation: eliminate cavings with experienced eyes high grading cuttings
- Analysis: XRF measurements using Delta Professional software with play specific calibration standards
- Hardware: Olympus Delta Professional XRF Analyzer device with Rh tube anode used with bench top secure setup, and remote operation trigger and data management
- Deliverables include spectral data and elemental composition (Mg to U)

XRF Quantitative Interpretation

- Elements measured by means of XRF Analysis are used to determine mineralogy
- Normative mineralogy (summary and detailed) are determined using an iterative regressive process targeting a play specific quantitative model
- Basic groups determined are Siliciclastics, Carbonates and Phyllosilicate, and include Quartz and Feldspar, Calcite and Dolomite, Clays, Pyrite
- Total Organic Carbon (TOC) is calculated based on radioactive components

OPERATIONS GEOLOGY

Chinook Consulting assists oil and gas companies with operations preparation, job administration, coordination and management.
Our team of experienced operations geologists add another layer of quality control and expertise to specific projects

Project Management

- Organizing rotations schedules for long term projects
- Lining up qualified geologists for multi-personnel projects
- Cross-checking safety compliance for geologists involved in a project
- Enforcing procedures and protocols for multi-well projects
- Journey management for remote and oversea jobs
- Continuous quality control of daily reports and field updates
- Geological field coordinators for multi-rig, multi-personnel projects
- On-demand geo-steering

Pre-spud Preparations



- Ordering drill cuttings supplies (bags and vials, washing solutions)
- Printing offset packages
- Pre-licensing regulatory reports
- Cross-checking safety compliance for geologists involved in a project
- Lining up third party equipment

Post drilling Operations



- Cuttings sample washing, vialing, shipping
- Core and cuttings storage
- Organizing petrographic analysis of core, cuttings, thin sections
- Shipping special samples to laboratories
- (IsoTubes, geo-jars, mud samples, bulk samples) for further investigation

DRILLING AND COMPLETIONS

Drilling Engineering and Operations 	<p><i>Design and implement a strong and easily implementable HSE program that would aim to ZERO incidents and recordables</i></p> <ul style="list-style-type: none"> • Well design and AFEs • Rig Contracting, Rentals and Drilling Services • Monitoring daily drilling activity • Participate in the field during Special Operations (i.e. Casing Installations, Cementing Operations, etc.
Well Delivery Optimization 	<p><i>Well Design and Delivery Process improvements</i></p> <ul style="list-style-type: none"> • Supply Chain contracting strategies • D&C Technology implementation • Drilling performance improvements • Fit for purpose Completions systems and fracking designs
	<ul style="list-style-type: none"> • Well Trajectory and Borehole stability • Casing design and setting points optimization • Drilling Fluids, BHA and Directional Tools design • Drilling Bits and Drilling Parameters
Abandonment Studies	<ul style="list-style-type: none"> • Geological and Petrophysical Characterization • Public Data Correlations (Wireline logs, Production data, Testing data, Aquifers) • Gas source identification • Carbon Isotope Analysis • Analysis of available abandonment techniques • Recommendations and abandonment Engineering programs • Perforating, feed rate, cementing • Abandonment program execution and supervision
Manpower Services	<ul style="list-style-type: none"> • Drilling and Completions Engineers • Superintendents • Geologists • Production Engineers • Reservoir Engineers • Wellsite Drilling and Completions Supervisors <p><i>Our wellsite supervisors provide day-to-day on-site leadership and supervision, with an emphasis on Safety and due diligence. Planning and scheduling, forecasts and preparation are included in the service.</i></p>

INTERNATIONAL OPERATIONS

Chinook Consulting assists oil and gas companies operating internationally with finding qualified personnel, identifying high quality services and products.

Integrated Services

- Engineering
- Safety training
- Technical training
- Logistics
- Wireline logging and perforating
- Reservoir testing
- Reservoir stimulation
- Environmental assessment and environmental management
- Data management

Personnel

Field coordinators and supervisors

- Oil and gas Engineers
- Technical personnel
- Geologists and mudloggers
- Petrographers and lab technicians
- Directional drillers and MWD operators
- Safety supervisors
- Rig workers

Project management

Experienced in coordinating multi-personnel projects

- Identifying solutions for project execution
- Regulatory pre-spud documentation
- Cross-checking safety compliance for personnel involved in a project
- Organizing equipment and supplies

