WE VALUE COLLABORATION BECAUSE WE BELIEVE THAT INFORMATION SHARED MAKES US MORE INFORMED AND BETTER ABLE TO CARRY OUT OUR CLIENTS’ VISION. WE ARE STRONG ADVOCATES FOR SCIENCE, AND WORK DILIGENTLY TO ENSURE THAT WE CONTINUOUSLY PROVIDE THE NECESSARY TOOLS FOR SUCCESS. WE DON'T BELIEVE THERE'S ANYTHING EASY ABOUT UNDERSTANDING GEOLOGY AND THE DIFFICULTIES EXPLORING FOR OIL & GAS. THAT’S WHY WE HAND PICK OUR EXCEPTIONALLY TALENTED GEOLOGISTS AND GEO-SCIENTISTS TO OUTPERFORM AND GIVE YOU THE INFORMATION YOU NEED.

WE BELIEVE IN DOING EXCEPTIONAL WORK. IT’S WHO WE ARE AND WHO WE’VE BEEN SINCE 1978 WHEN WE STARTED OUT AS A SMALL, CALGARY BASED GEOLOGICAL WELLSITE COMPANY. SINCE THEN, WE’VE TAKEN OUR EXPERTISE ALL OVER THE WORLD AND CREATED OUR OWN GEOLOGIC LAB & ANALYTICS FACILITY. WE CONTINUE TO STRIVE TO PROVIDE MORE FOR OUR CLIENTS.

LET PRO GEO DO WHAT WE DO BEST.
Pro Geo Consultants was founded in 1978 in Calgary, Canada and has managed over 12,000 wellsite operations in over 20 countries over the past 40 years. Pro Geo has a strong focus on quality personnel, clear communication and diversified experience in our core service business units.

Geological Services

- **Geological Wellsite Supervision** cuttings analysis, mudlogging, gas chromatography, petrophysical log analysis and quality control, core and casing point selection, core processing, core evaluation, real time XRF acquisition, data acquisition compilation and interpretation, well presentations and personnel training and supervision.

- **Sample Collection & Processing** mud, core, chip, cuttings, isojars, isotubes.

- **Geosteering** (and horizontal supervision) real time decisions and borehole position corrections using geological and geophysical downhole measurements to ensure optimal wellbore placement while drilling, from wellsite or remotely.

- **Operations Geology & Project Management** well planning, data management, contractor evaluation & supervision, wireline log evaluation. subsurface & drilling risk identification, manifests & data documentation, geophysics, petrophysics, reservoir engineering, drilling & engineering consultants, disposal well assessments.

Laboratory & Analytics

- **Core and Sample Analysis** including full petrography, SEM, XRD and mobile and bench XRF.

- **Enhanced Reservoir Studies** including source rock geochemistry, biostratigraphy and ichnological analysis.

- **Data Integration** including reservoir characterization and integrated sequence stratigraphy.

- **Exploration & Development Support** including regional studies, evaluations, mapping, play generation, petrophysics, basin analysis, reporting and follow-up.
PRO GEO PROJECT EXPERIENCE

HIGHLIGHTS

Pro Geo Consultants geologists have worked in over 20 countries including Canada, United States of America, Oman, Ecuador, Venezuela, French Guiana, United Kingdom & the North Sea, Albania, Turkey, Syria, Iraq, Kurdistan, Qatar, Iran, Saudi Arabia, Bahrain, Yemen, Pakistan, Egypt, Libya, Sudan, Thailand and New Zealand.

CANADA

Long-term Projects

- 10-rig development drilling program for Tourmaline Oil Corp. since its inception in 2008 with over 500 wells drilled to date. Over 1,000 wells combined total with Berkley Petroleum, Duvernay Oil Corp and Tourmaline, who all share the same management team, with up to 20 Pro Geo wellsite consultants contracted at any given time.

- Over 1,400 wells with Renaissance Energy from their inception in 1982 until their sale to Husky Energy in 2000, with up to 17 Pro Geo wellsite geologists contracted at any given time.

- More than 250 wells for Penn West from 2001 to 2015 including Cardium, Montney and Slave Point formations.

- From 1996 to 2015 with Canadian Natural Resources (CNRL), almost 300 wells across BC and Alberta in a variety of formations, ranging from heavy oil and shallow gas to deep basin Montney wells.

- Almost 400 wells for Encana from 2003 to 2013, with more than 100 deep basin gas wells in NE BC and more than 100 shallow gas wells in central Alberta.

- More than 800 Petro-Canada wells over 25 years across BC, AB, SK and NWT, with more than 500 stratigraphic and cored wells in the oilsands from 1997 to 2001.

- Montney development program with Shell from 2009 to 2016 with close to 300 wells in NE BC and NW Alberta.

Geosteering Projects

- Over 100 wells geosteered for EOG between 2011 & 2014 at Wapiti, Joffre, Horn River, Waskada and Pierson.

- Exploratory pool well in Ontario for Grandview Energy in 2013.

- 4 wells geosteered for Velvet in 2018 to date at Gordondale & Bezanson.

Shale Projects

- Over 900 Montney and Duvernay wells to date for Tourmaline, Berkley, Duvernay, Talisman, Painted Pony, CNRL, Compton, Conoco, Husky, Penn West, Trident, Velvet, Raging River (Baytex), Progress, Petro-Canada and Shell.

- 9 Utica & Lorraine shale wells from 2008-2010 for Talisman in Quebec.

Offshore & Deepwater

- Supervised the only offshore arctic well in Canada in last 25 years with Devon Canada.

- Beaufort Sea project and East Coast Offshore projects with Esso.

Arctic Exploration

- Canadian arctic exploration programs over 23 years and more than 100 wells with Chevron, Devon, Petro-Canada and Esso including 4 rigs with Petro-Canada and 67 wells with Esso Resources at Norman Wells, NWT and Yukon Territory.
Coal Bed Methane (CBM) & Shallow Gas Projects

- Over 1,000 CBM and shallow gas wells for Trident, Devon, CNRL, Nexen and Encana in a variety of formations including the Mannville and Horseshoe Canyon.

Oilsands Stratigraphic Wells, SAGD & Thermal Programs

- Over 1,000 wells to date for Petro-Canada, Chevron, Amoco, Devon, Total E&P, Paramount, KNOC, Petrobank and Devon in the Dover, Birch, Lewis, Hangingstone, McMurray, Germain, Leismer and Liege areas.

Heavy Oil Projects

- Over 400 wells in Cold Lake and Lloydminster areas including Esso Cold Lake project.
- Over 100 wells for Pengrowth at Lindbergh from 2007 to 2014.

LAB & ANALYTICS PROJECTS

- Numerous studies examining core and thousands of thin-sections, SEM, XRF and XRD samples.
- Some of the industry’s most active plays including the Wilrich, Notikewan, Falher, Cardium, Duvernay, Charlie Lake and Montney formations.
- Petrography, elemental, mineralogy, clay content, porosity, pore-throat geometry and TOC investigations.
- Exploration and development work for Tourmaline, Ikkuma, Altura, Corridor, Perpetual, Raging River (Baytex), NuVista and Coco Liso (Gold - Ecuador), among others.
- Academic research projects in association with University of Calgary and Mount Royal University.

USA

- Geological Wellsite Supervision on a 5-state directional and horizontal drilling program with Talisman/Fortuna between April 2008 and January 2015 in Louisiana, Wyoming, North Dakota, Utah and Montana.
- Projects in west Kansas, Denver basin and Appalachian overthrust.

ECUADOR


OMAN

- Over 100 wells of Geological Wellsite Supervision experience in wells up to 6,500m.
- Vertical, deviated, horizontal and geosteering wells in sandstone (Natih, Shuaiba, Kharai and Khuff groups), carbonate (Akhdar, Alkhalata, Haushi, Misfar and Haima groups) and basement formations.
- Supervision of LWD, Mudlogging, Well Testing, Wireline Logging and Coring operations.

QATAR

- Over 20 wells of Geological Wellsite Supervision experience in vertical, deviated and horizontal wells.
- Geosteering through thin, complex carbonate reservoir.
- Prepare and plan well prognosis, well path and supervise service teams (LWD, DD, ML etc.)
- Core barrel 100% recovery in problematic reservoir zone.
- Training of junior geologists and petroleum engineers.
PRO GEO LAB & ANALYTICS

PETROGRAPHY

Detailed study of thin-sections with transmitted light microscopy helps visualize textural and spatial relationships within the rock. Petrography is a crucial step in determining a rock’s physical properties which leads to a more complete understanding of your facies.

Petrography provides detailed descriptions of:

- Framework mineralogy
- Statistical point counts
- Diagenetic minerals
- Cements and events
- Porosity nature and permeability
- Microfracturing
- Allochems
- Facies determination

DETAILED CORE & CHIP LOGGING

The art of microscopic sample logging is the first step to understanding well-bore lithology. Defining and characterizing lithological boundaries in a comprehensive lithological log provides a framework upon which further investigation can be based.

Our sample and core logging experts provide:

- Detailed comprehensive strip log
- Dunham and Folk classifications
- Porosity and permeability estimates
- Sneider classification system (permeability)
- High resolution core and sample photography
- Detailed interpretive final report
X-RAY FLUORESCENCE

Using an intense XRF spectrometer beam focused on the sample, some of the energy is scattered and some is absorbed depending upon the sample’s chemistry.

The resulting fluoresced X-rays are used to determine:

- Elemental composition
- Analyse major and critical trace elements in core and cuttings
- Chemostratigraphy
- Establish facies trends
- Determine brittleness range potential (vs. ductility)
- ‘Fingerprint’ geological zones
- Fracture zone potential
- Ascertain contamination issues
- Soils/ceramic/obsidian/metals analysis
- Total Organic Carbon (TOC) estimation

Along with our leading-edge lab equipment, our Bruker Tracer portable XRF can yield near real-time, non-destructive XRF data acquisition at the worksite.

X-RAY DIFFRACTION

XRD measures the intensity of X-rays, which are diffracted into wave patterns by the atoms in the crystal compounds (minerals) contained in a sample such as a core or cuttings.

This is used to:

- Identify mineralogical composition
- Calibrate mineral volume calculations derived from well log data
- Define clay components
- Establish facies trends
- Determine Brittleness

SCANNING ELECTRON MICROSCOPY

SEM characterizes materials at very high magnification and is well suited for shale hydrocarbon reservoir analysis.

SEM enables us to:

- Observe a minute and solid specimen, or complex surface topography
- Provide an observer with a familiar three-dimensional image
- Visualize porosity and permeability
- Understand pore-throat geometry
- Evaluate clay mineralogy
- Determine microscopic structural relationships

During reservoir characterization XRF, XRD, and petrographic studies are complementary to each other. These studies, along with SEM, are valuable tools for well-bore placement and completion planning.
Enhanced Reservoir Studies can help identify new plays and yield information on hydrocarbon maturation and migration pathways, diagenetic history of a formation, gross depositional environments, bathymetry, facies and short to long distance formation correlations.

**SEQUENCE STRATIGRAPHY (REGIONAL TO FIELD SCALE)**
A powerful predictive tool for regional basin analysis, it provides long distance correlation – assessing the source, the reservoir and seal integrity to identify new plays and increase the value of existing ones.

- Outcrop and/or core based high resolution sequence stratigraphy and depositional modelling
- Unraveling tectonic history, defining paleogeography, and facies mapping
- Identification of new plays and concepts

**BIOSTRATIGRAPHY**
Capturing the microfossil distribution in rocks reveals age and depositional environments to help correlate strata between locations to develop a stratigraphic framework.

- Chronostratigraphic dating to confirm mineral rights
- High resolution for precise correlation
- Biofacies analysis for depositional modelling
- Chronostratigraphic correlation of sequences
RESERVOIR CHARACTERIZATION

Reservoir Characterization is one of the significant elements of hydrocarbon exploration and development.

We offer comprehensive solutions including:

- Quick-look thin-section analysis for rock type and total porosity
- Detailed petrography for developing microfacies scheme and interpreting depositional environments
- Mineral distribution and rock fabric identification
- Depositional modelling and accessing diagenesis history
- Qualitative and quantitative clay mineral identification and their distribution in pore spaces
- Porosity estimation, accessing pore geometry and detailed reservoir quality assessment
- Detailed core studies for lithofacies, sedimentary features, ichnofacies and depositional environments
- Integration of core, well-cuttings analysis with log data
- Core porosity/permeability data integration with rock facies and logs to pick reservoir intervals and establish flow units

SOURCE ROCK GEOCHEMISTRY & CHEMOSTRATIGRAPHY

Understanding the source rock composition and its relationship with the geological environment to:

1. Identify source rocks and determine the amount, type, and maturation level of the organic matter;
2. Evaluate the potential timing of petroleum migration from the source rock;
3. Assess the potential migration pathways;
4. Correlate petroleum compounds found in reservoirs.

- Initial source rock analysis
- Total Organic Carbon (TOC)
- RocEval pyrolysis
- Vitrinite reflectance (maturity indicator)
- Source rock mapping
Geosteering allows you to make real-time decisions and on-the-fly borehole position corrections using geological and geophysical downhole measurements to ensure optimal wellbore placement while drilling. By incorporating offset data with MWD, LWD, Image logs, 2D and 3D seismic data and geological models, geosteering can allow you to make more informed decisions about your well, either from wellsite, remotely or in combination.

**ADVANTAGES**

- **Real-time data stream**, specialized software and customized reporting
- **On-site, remote or hybrid/combination for continuous 24/7 drilling supervision**
- **Geosteering specialist geologists** deployed at rig (on site) or from remote office location (client in-house or remote geosteering center) providing professional interpretation and recommendations
- **Clear, direct and efficient communication between client, geosteering geologist and directional driller ensures the well lands and remains in the target zone**
- **Maximizes advantages of leading technologies** including rotary steerable directional drilling tools, near bit sensors, high resolution image logs, 3D seismic and geomodelling
- **Continuous, real-time, accurate assessment of drill bit position**
- **Proactive adjustment of wellpath inclination and azimuth** to stratigraphic markers and optimal porosity targets
- **Increased drilling efficiency** (increased ROP, optimal drilling window, longer lateral reach, less sliding, less tortuous borehole)
- **Optimal reservoir targeting & penetration to maximize percentage of borehole in-zone**, resulting in improved completions, production and ROI
MANAGEMENT & KEY PERSONNEL

Robert (Bob) Earle, P.Geol.
PRESIDENT
- B.Sc. Geology (University of Calgary)

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OPERATIONS MANAGER
- B.Sc. (Honours) Geology (University of Regina)

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James Ablett
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- 2011 Ph.D. (Carbonate Sedimentology; University of Erlangen-Nurnberg, Germany)
- 1986 M.Sc. (Applied Geology; Punjab University, Lahore)

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- 2007 Ph.D. (Stratigraphy; Punjab University, Lahore and BGR, Germany)
- 1994 M.Sc. (Applied Geology; Punjab University, Lahore)

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- 1984 Ph.D. (Tectonics; University Paris VI)
- 1983 M.Sc. (Sedimentology; University of Calgary)
- 1980 M.Sc. (Structural Geology; University Paris VI)
- 1979 Maitrise (Geology; University of Lille, France)

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- 1997 Ph.D. (Stratigraphy; Peshawar University; Post-doctorate Potsdam University, Germany)
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- 2004 M.Sc. (Sedimentology/Reservoir Characterization; Punjab University, Lahore)
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