1. **Name of project:** Diagenetic controls on reservoir quality and petrophysical properties in the Lower Triassic Montney formation - a major unconventional liquids and gas play in western Canada - with implications for fluid distribution

2. **Brief synopsis/areas of geosciences or engineering (50-75 words):** The Montney Formation is a major resource play developed largely in siltstones. This proposed research investigates the relationship between diagenesis and reservoir quality and attempts to identify critical factors that distinguish conventional from unconventional hydrocarbon accumulations. The study will encompass sedimentary petrology, geochemistry, and petrophysics. In order to up-scale results obtained from small scale samples and create a predictive model for reservoir quality, data will be integrated with well logs into Gamls software.

3. **Bullet list of 5-7 main outcomes/goals:**
    - Description of the mineralogical composition of the Montney and the paragenesis of diagenetic phases.
    - Build a robust basin-wide model for reservoir quality in the Montney Formation.
    - Assessment of porosity, permeability and other petrophysical properties of the Montney reservoir.
    - Integration of small scale analyses results (mineralogical composition and porosity) with down-hole logs to create an upscaled lithological model of the basin with predicted porosity distribution.
    - Build models that relate fluid type and fluid distribution to petrophysical properties.

4. **In two or three sentences, describe why your research is important. Please mention who will benefit from your work:** A major unconventional resource play, the Montney contains an estimated 450 TCF of gas 14,521 million barrels of NGLs and 1,125 million barrels of oil. As a siltstone formation, the Montney represents a type of reservoir that is virtually unexploited yet may be globally very significant. This research will lead to a comprehensive diagenetic model of the Montney Formation for reservoir quality prediction, and because both conventional and unconventional pools exist in the Montney, this formation provides us the opportunity to identify the geological and petrophysical variables that distinguish an unconventional from a conventional clastic reservoir.

5. **Timeline with milestones (12 month/18 month):**
    - 6 months - Identify conventional and unconventional pools in the basin and select wells and cores for sampling; describe mineralogy and diagenetic phases in selected samples. Build log interpretation models for lithology and modeling porosity and water saturation.

- 12 months - Describe the paragenesis for the deep, middle and shallow Montney; perform porosity and pulse decay permeability measurements on intact and crushed samples ; establish methods for continuous permeability measurements and permeability calculation and creating a robust and consistent poroperm dataset for the Montney Formation;
- 18 months - Build statistical models relating rock composition and diagenetic phases to porosity and permeability, and establish whether statistically significant differences exist between the conventional and the unconventional hydrocarbon pools identified in the basin.

6. **Funding amount needed to achieve first basic goals within 12 months. Please provide a brief summary overview of your budget. List costs of 5-10 main items.**
    - Presentation at the AAPG Geosciences Technology Workshop (Unconventionals Update, Austin, November 4-5): $2000.
    - Inorganic chemical analyses of 3 cores; 50 samples for core: 150 samples * $55 per sample: $12,000.
    - Organic chemical analyses of 3 cores; 50 samples for core: 150 samples * $35 per sample: $5,250.
    - Hg injection on 6 cores; 30 samples per core: $150 per sample: $4,500.
    - SEM: $40 per hour; 1 hour per sample, 30 samples per core, 6 cores: 180 hours: $7,200.
    - SEM CL: $70 per hour; 1 hour per sample, 30 samples per core, 6 cores: 180 hours: $12,600.
    - Thin sections for 6 cores; 20 thin sections per core: $60 per thin section (polished and stained) $1,200.
    - Steady state permeability measurements (no cost).
    - Crushed rock pulse decay measurements on 6 cores; 30 samples per core: $50 per sample: $1500.
    - Plugs pulse decay measurements on 6 cores; 30 samples per core: $50 per sample: $1500.

      Total: $47,750.

7. **In the process of gaining background knowledge in the field of your proposed research, who did you find to be the top two or three researchers? What are the main concepts that are being explored? Please briefly describe.**
    - Graham R. Davies, Thomas Moslow, John-Paul Zonneveld - sedimentology, stratigraphy and sequence stratigraphy of the Montney Formation.
    - Nicholas Harris, Shirley Dutton, Kitty Milliken - Tight rocks diagenesis.
    - Alan Byrnes, Keith Shanley - Petrophysics and tight reservoir characterization.

8. **Photo:** Attached.

9. **Who will benefit?** This project will be beneficial for companies who are currently exploring and developing the Montney Formation. In addition, the methods developed in this study will be beneficial for any company interested in the geology of unconventional clastic reservoirs.