ADVANCED GEOTECHNOLOGY

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Transeuro Energy Corp.
Suite 700 Bow Valley Square II
205 - 5th Ave SW
Calgary, AB, T2P 2V7

Attention: **Mr. James Mott**
Consultant

Dear Mr. Mott:

Re: First-order Assessment of the Rock Mechanical Properties of the Mattson Formation, Beaver River Field, Yukon Territories

1. Introduction

Advanced Geotechnology (AG) was requested by Mr. James Mott, a consultant for Transeuro Energy Corp. to provide a first-order assessment of the rock mechanical properties of the Mattson Formation, in the Beaver River Field, located in the Yukon Territory. Available core from this formation from PAN AM Beaver YT G-01 (00/G01 60-10 124-15/0), located at the core repository of Natural Resources Canada in Calgary, was profiled with an Equotip-type hardness tester to derive static Young's moduli (E_s) to use in hydraulic fracture design and analysis.

2. Methodology

The Equotip tester is designed to measure the hardness of materials. This small electronic device uses a spherical carbide test tip to impact a rock surface under a spring force, from which it rebounds. The impact and rebound velocities are measured and reported as a hardness number, L, which can be correlated to the static Young's modulus (E_s) and unconfined compressive strength (UCS) of the rock.

Samples are placed in a V-notch cut in an aluminum block to provide a solid base. Advanced Geotechnology's Equotip tester, with a D-type impact tip, is then used in a vertical position to measure the hardness. Five measurements are usually recorded both perpendicular and parallel to bedding or the dominant fabric in the rock sample. The mean and standard deviation are calculated for each group of five measurements.

3. Results

Twelve boxes of core from Mattson Formation (8764-8812 ftKB MD) were tested with the device. The core was composed of silty grey shale with a fairly similar texture throughout as shown in the photograph in Figure 1. Much of the core was broken into irregular pieces with many intervals of rubble. A few sections of the slabbed core were in better shape than the rest of the core. Most parts of the core were desiccated and flaked easily along thinly laminated shale beds. Equotip tests parallel to these damaged shale beds gave lower hardness numbers than tests performed on surfaces perpendicular to bedding.

The mean E_s value derived from hardness numbers tested perpendicularly to bedding was 16.2 GPa, while parallel to bedding the mean value was 13.9 GPa. These results are plotted on two profiles in Figure 2. A small number of samples that were not seriously affected by desiccation yielded higher hardness numbers measured parallel to bedding compared to measurements made perpendicular to bedding. This is more typical of shale core that has not been damaged by desiccation or handling.

4. Conclusions

1. Equotip-derived Young's moduli measured perpendicular to bedding ranged from 3.2 GPa to 36.1 GPa with a mean of 16.2 GPa and a standard deviation of 7.1 GPa.

2. Equotip-derived Young's moduli measured parallel to bedding ranged from 2.1 GPa to 36.3 GPa with a mean of 13.9 GPa and a standard deviation of 7.3 GPa. Due to damage caused by drying and desiccation the measurements parallel to bedding are lower than expected and are not believed to be representative of in-situ properties.

3. Based on the Young's moduli measured perpendicular to bedding there is an interval in the Mattson Formation between 8779 and 8788 ft KB MD that is stiffer than the Mattson above and below, and could act as a barrier to hydraulic fracture growth, or at a minimum, a fracture growing vertically through this interval will possess a narrower aperture.

5. Recommendations

1. Future work on characterizing the rock mechanical properties of the Mattson Formation and its caprock could include core testing of well A-5 PAN AM Beaver D-064-K/094-N-16 or another offset well. A typical program could include non-destructive Equotip, Schmidt hammer, ultrasonic velocity testing and destructive uniaxial and/or triaxial testing for deriving Young's modulus, and rock compressive strength, and other geomechanical parameters.

2. Rock mechanical properties derived from a laboratory testing program should be combined with petrophysical log analysis to produce a profile of rock dynamic and static elastic properties. This information can be used in the design and evaluation of hydraulic fracture treatments in gas shales.

3. Mineralogical and total organic carbon data are often correlatable to rock mechanical and acoustic properties in shales. A pilot testing program is recommended to evaluate whether such a relationship exists for this shale.

6. Reference

Verwall, W. and Mulder, A., **Estimating Rock Strength with the Equotip Hardness Tester**, Technical Note, *International Journal of Rock Mechanics, Mining Sciences & Geomechanics Abstracts, Vol.* 30, No. 6, 659-662, 1993.

Please do not hesitate to contact the undersigned if you have any questions on the above. Thank you for the opportunity to work with Transeuro and we look forward to assisting your team in the future.

Yours truly,
for ADVANCED GEOTECHNOLOGY

Pat McLellan, M.Sc., P.Eng.
Principal Consultant

Queena Chou, M. Sc., G.I.T.
Project Geologist

TOP (Core 3, Box 1) **BOTTOM**

TOP (Core 3, Box 10) **BOTTOM**

Figure 1: Core box photos of the Mattson Formation (8764-8812 ftKB MD), PAN AM Beaver YT G-01 well, Beaver River Field, Yukon Territories.

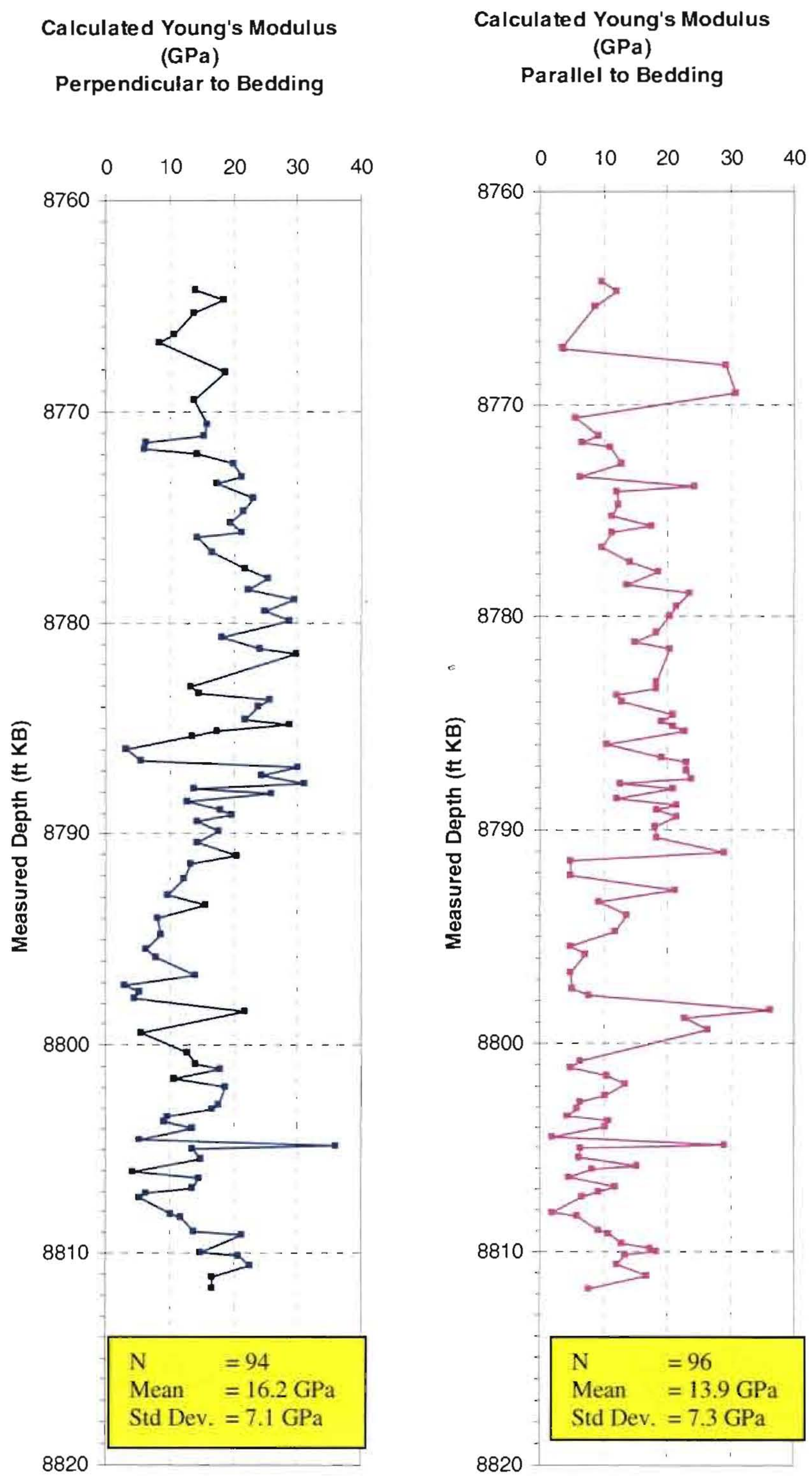

Figure 2: Equotip-derived Young's moduli measured on shale core from PAN AM Beaver YT G-01, the Mattson Formation, Beaver River Field, Yukon Territories.