Biax Experiment *(rev. 27 June 2019)*

Exp. Name: **P5356 WG Frac 5-20**   Date/Time: **10/3/19**

Operator: **Wood/ Mamogharam**   Hydraulics start: _____

Example name: PXXXXBttMatNN   Hydraulics end: _____

Sample Block Thickness w/ no gouge:

___ Steel 5x5 cm, _____mm   ___Vessel (Small Single Direct)-Frits: _____

___ Titanium 5x5 cm, _____mm   ___Vessel (Large Single Direct)

___ Steel 10x10 cm, _____mm   ___Vessel (5x5 Grooved)-Frits: _____

___ Titanium 10x10 cm, _____mm   Vessel Side Blocks: _____ Empty Block + frits: _____

For Current Calibrations see: ~gpfs/group/cjm38/default/Calibrations/
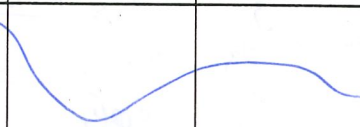
Layer Thickness (total on bench): _____mm Under Load: _____mm@sample_____

Material (Qtz, Granite, ?): **WG, Pre-fracture (from P5346 intact)**
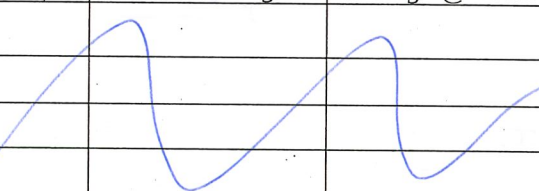
Particle Size, Size Distribution: _____

Load cells: Contact area: **0.002233036 m²**

Load cell name	Calibrations (mV/kN)		Target stress (MPa)	Init. Voltage	Volt. @ load
62 mm H	LG: 18.561	HG: 172.1	*Hor:* **5,10,15,20**	~~0.00393~~	
(44 mm H)	LG: 12.3	(HG: 123.9)			
22 mm H	Gain: 773.6		*Calibration:* (V/MPa) **0.2767**	**-0.038339**	
62 mm V	LG: 19.73	HG: NA	*Vert:*		
44 mm V	LG: 32.3	HG: 309			
22 mm V	Gain: 732.1		*Calibration:* (V/MPa)		

Vessel Pressure: Pore Fluid: _____

Calibrations (V/MPa)		Pressures (MPa)	Initial Voltage	Voltage @ Load
LG: 0.147	HG: 1.52	*PpA:*		
LG: 0.146	HG: 1.48	*PpB:*		
Gain : 0.1456		*Pc:*		
LG: NA	HG: NA	*Pdiff:*		

Data Logger Used: **8-Channel**   _____ Control File

Horz. DCDT: __ Long rod   __ Short rod   Vert. DCDT: _____ TT 2" Gain: High/Low

(LR - HG: 0.622 mm/V   LG: 1.27 mm/V   *(HG: 0.57 mm/V   LG: 2.85 mm/V)*

(SR - HG: 0.64 mm/V) LG: 1.32 mm/V)

Purpose/Description: _____

_____

_____

Acoustics blocks used **L - block** _____

Temperature (°C): _____   Relative Humidity (%): _____

@ Hyd. Power Supply (HPS)   Chilled water at HPS   Chiller Unit   Process water at Chiller

14. Tank Temp (ºC): _____   1. Temp In (°F): _____   6. Panel Temp (°F): _____   10. Temp In (°F): _____

15. Temp. Out (ºC): _____   2. Pres. In (psi): _____   7. Panel Pres. (psi): _____   11. Pres. In (psi): _____

16. Pres. Out (psi): _____   3. Temp Out (°F): _____   8. Near Pres. In (psi): _____   12. Temp Out (°F): _____

          4. Pres. Out (psi): _____   9. Near Pres. Out (psi): _____   13. Pres. Out (psi): _____

          5. Flow (lpm): _____

3333 @ 5 MPa

3A30 ↗100 Hz, check Piezo-stack → Good!

7600 ↗10 kHz, Run1

2049761S ↓1 Hz, ↗NS, ↗10 kHz, Run2

30347700 ↓1 Hz, ↗NS, ↗10 kHz, Run3

A2007790 ↓1 Hz, ↗NS⁼, ↗100 Hz, Run4   offset = 1.422

42377400 ↓1 Hz, ↗100 Hz, Run5

42478900 ↓1 Hz, ↗100 Hz, Run6

42609400 ↓1 Hz, ↓NS = 1 MPa, Disp Mode, leave overnight

Piezo Stack Calibration - 3.75V/MPa

R	T
11	
8	8
5	5
2	2

PART ② B

1100 ↗NS = 10 MPa

2110 ↗10 kHz, Run7

2005160 ↓1 Hz, ↗10 kHz, Run8

3052370 ↓1 Hz, ↗10 kHz, Run9

42012400 ↓1 Hz, ↗100 Hz, Run10

4237400 ↓1 Hz, ↗100 Hz, Run11

4248600 ↓1 Hz, ↗100 Hz, Run12

4261200 ↓1 Hz

R57 unplugged during last ~10s of run? → FIXED

PART. C

108 @ 15 MPa

200 ↗10 kHz, Run13

20490200 ↓1 Hz, ↗10 kHz, Run14

30800400 ↓1 Hz, ↗10 kHz, Run15

42280600 ↓1 Hz, Panel → Ext 1, ↗100 Hz, Run16

42637802 ↓1 Hz, ↗100 Hz, Run17

42744751 ↓1 Hz ↗100 Hz Run18

42876625 ↓1 Hz

42876880 ↓NS ≈ 1 MPa, Disp Mode, lock, leave overnight

PART D

#520 @ 20 MPa

#600 ↑10kHz, Run 19

#20000700 ↓ 1Hz, ↑10 kHz, Run 20

#30040800 ↓ 1Hz, ↑10 kHz, Run 21

#42091030 ↓ 1Hz, ↑100 kHz, Run 22

#42458200 ↓ 1Hz, ↑100 Hz, Run 23

#42561400 ↓ 1Hz, ↑100 Hz, Run 24

#42690700 ↓ 1Hz, lock, Ext 1 → Panel, ↓ NS ≅ 1 MPa
        Disp Mode, unplug Piezo-stack.

#42691920 unload, End of Experiment

Oscillations Protocol

Piezo-Stack Oscillations
Amp1 = [0.2, 0.4, 0.6, 0.4, 0.8, 0.4, 1.0]MPa @ 10 Hz
Amp2 = [0.2, 0.4, 0.6, 0.4, 0.8, 0.4, 1.0]MPa @ 100 Hz
Amp3 = [0.2, 0.4, 0.6, 0.4, 0.8, 0.4, 1.0]MPa @ 200 Hz
F1 = [10, 50, 100, 200, 250]Hz @ 0.4 MPa
F2 = [10, 50, 100, 200, 250]Hz @ 1.0 MPa
Biax Oscillations
Amp4 = [0.2, 0.4, 0.6, 0.4, 0.8, 0.4, 1.0]MPa @ 0.1 Hz
Amp5 = [0.2, 0.4, 0.6, 0.4, 0.8, 0.4, 1.0]MPa @ 1.0 Hz
Amp6 = [0.2, 0.4, 0.6, 0.4, 0.8, 0.4, 1.0]MPa @ 10 Hz
F3 = [0.1, 1.0, 10]Hz @ 0.4 MPa
F4 = [0.1, 1.0, 10]Hz @ 1.0 MPa

Experiment

Run1: ✓ Amp1, Amp2, Amp3	**Run7:** ✓ Amp1, Amp2, Amp3	**Run13:** ✓ Amp1, Amp2, Amp3	**Run19:** ✓ Amp1, Amp2, Amp3
Run2: ✓ F1, F2	**Run8:** ✓ F1, F2	**Run14:** ✓ F1, F2	**Run20:** ✓ F1, F2
Run3: ✓ Amp2, F2	**Run9:** ✓ Amp2, F2	**Run15:** ✓ Amp2, F2	**Run21:** ✓ Amp2, F2
Run4: ✓ Amp4, Amp5, Amp6	**Run10:** Amp4, Amp5, Amp6	**Run16:** ✓ Amp4, Amp5, Amp6	**Run22:** ✓ Amp4, Amp5, Amp6
Run5: ✓ F3, F4	**Run11:** ✓ F3, F4	**Run17:** ✓ F3, F4	**Run23:** ✓ F3, F4
Run6: ✓ Amp5, F4	**Run12:** ✓ Amp5, F4	**Run18:** ✓ Amp5, F4	**Run24:** ✓ Amp5, F4

Normal Stresses

MPa	Volt
5	1.422
10	2.805
15	4.188
20	5.572

piezo stick calibration - 3.75 V/MPa

Internal Cables

Surface   Vessel

○   ⑪   ○

○   ⑧   ○

○   ⑤   ○

○   ②·   ○

Surface   Vessel

○   ⑧   ○

○   ⑤   ○

○   ②   ○
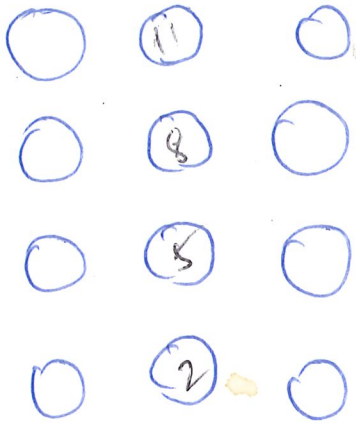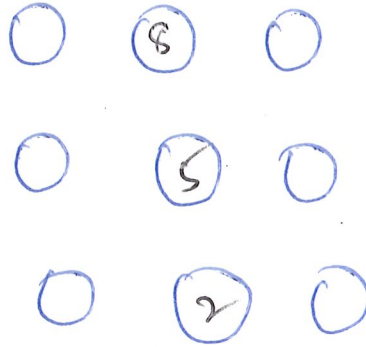
Acoustic Cables

	60		
	59		
	58		
	57		

	8		
	7		
	6		