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ABSTRACT: The abstract should be brief – one paragraph between 150 to 200 words. It must clearly describe the most important contributions of the work. The abstract must be typeset in 10 pt Times New Roman font.

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The main text in the paper should be typeset in 11 pt Times New Roman font with single-line spacing. Text should be full justified.

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4.2. Numbering

All sections and sub-sections must be numbered in Arabic numerals.

4.3. Lists

You may list items in your paper using bullets:

- Item No. 1

Table 1: Rock properties for rocks samples X and Y, as well as representative field values (Madyarov et al., 2021).

| | Field Scale | X | Y |
|----------------------------------|-------------|-------|-------|
| E_H (GPa) | 30 | 17.55 | 23.2 |
| ν_H | 0.22 | 0.24 | 0.22 |
| K_{Ic} (MPa·m ^{1/2}) | 1.5-2.21 | 2.21 | 1.87 |
| Porosity (%) | | 9.16 | 10.94 |
| Permeability (mD) | | 0.1 | 0.443 |

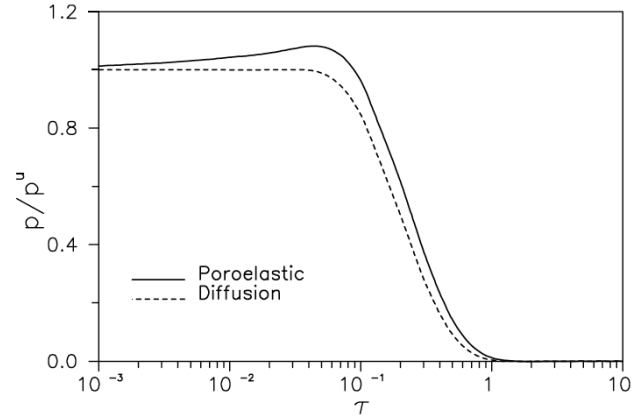


Fig. 1: Normalized pore pressure history for a pressurized cylindrical borehole, displaying the so-called Mandel-Cryer effect (Detournay and Cheng, 1993).

- Item No. 2

Or Roman numerals

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Equations displayed in your paper should be numbered sequentially, with an equation centered in the middle of a column, and its number set flush to the right edge of the column and enclosed in parentheses as shown below. In the text of the paper, equations may be abbreviated, e.g., Eq. (1) is the classical Mohr-Coulomb failure criterion and Eq. (2) is the generalized Hoek-Brown criterion (Hoek and Martin, 2014).

$$\tau = \sigma \tan \phi + c_0 \quad (1)$$

$$\sigma'_1 = \sigma'_3 + \sigma_{ci} \left(m_b \frac{\sigma'_3}{\sigma_{ci}} + s \right)^\alpha \quad (2)$$

Table 2: Microparameters used in *PFC* modeling (Hazzard et al., 2000).

| Microparameter | Description | Lac du Bonnet Granite | Westerly Granite | Ekofisk Chalk |
|------------------------|----------------------------------------------|-----------------------|------------------|---------------|
| E_c , GPa | Young's modulus at contact | 100 | 100 | 6 |
| K_n/K_s | ratio of particle normal to shear stiffness | 2 | 2 | 4 |
| μ | particle friction coefficient | 0.7 | 0.7 | 0.3 |
| σ_c (mean), MPa | average normal bond strength | 162 | 300 | 100 |
| | standard deviation of distribution of normal | | | |
| σ_c (s.d.), MPa | bond strength | 44 | 80 | 30 |
| τ_c (mean), MPa | average shear bond strength | 243 | 450 | 100 |
| | standard deviation of distribution of shear | | | |
| τ_c (s.d.), MPa | bond strength | 66 | 120 | 30 |

6 FIGURES

The term “figure” denotes graphical representations including charts, graphs, drawings, photographs, etc. Figures must be inserted as close as possible to their first reference. Figures must be numbered consecutively and must have descriptive titles placed just below them. Figure captions must be typeset in 10 pt Times New Roman, see Fig. 1. If photographs are being inserted, color or black and white is acceptable. Large figures or tables may straddle both columns as shown in Table. 2.

7 TABLES

In the text, tables must be inserted as close to the first point of reference as possible. Please leave some space above and below the table. Tables must be numbered sequentially in the text with Arabic numerals. Captions must be centered above tables. Tables and table captions must be typeset in 10 pt Times New Roman font, see Table 1.

8 CITATION

Citation should follow the style of Author-year with the bibliography formatted according to the style of APA (American Psychological Association). Below a few examples of how journal articles, a book, a chapter in a book and a published paper in proceedings, e.g., Hoek and Bieniawski (1965), Haimson and Fairhurst (1967), Detournay and Cheng (1993), Crouch and Starfield (1983), Zoback et al. (1989), Hazzard et al. (2000), Ciardo and Lecampion (2021) and Madyarov et al. (2021), are formatted in the references.

Please note that the bibliography style file “apa.bst” needs to be included in the OverLeaf folder. APA 7th Edition is recommended if you choose to use the build-in style in EndNote for MS Word.

REFERENCES

1. Ciardo, F. and Lecampion, B. (2021). Aseismic slip propagation in fractured rock masses driven by pore-fluid diffusion. In *Proc. 55th US Rock Mechanics/Geomechanics Symposium*, Houston, TX. American Rock Mechanics Association.
2. Crouch, S. L. and Starfield, A. M. (1983). *Boundary element methods in solid mechanics*. George Allen & Unwin, London, 1st edition.
3. Detournay, E. and Cheng, A. H.-D. (1993). Fundamentals of poroelasticity. In Fairhurst, C., editor, *Comprehensive Rock Engineering*, volume 2, pages 113–171. Pergamon, New York.
4. Haimson, B. and Fairhurst, C. (1967). Initiation and extension of hydraulic fractures in rocks. *SPE J.*, 7(03):310–318.
5. Hazzard, J. F., Young, R. P., and Maxwell, S. C. (2000). Micromechanical modeling of cracking and failure in brittle rocks. *J. Geophys. Res. Solid Earth*, 105(B7):16,683–16,697.
6. Hoek, E. and Bieniawski, Z. T. (1965). Brittle fracture propagation in rock under compression. *Int. J. Fract. Mech.*, 1(3):137–155.
7. Hoek, E. and Martin, C. D. (2014). Fracture initiation and propagation in intact rock—a review. *J. Rock Mech. Geotech. Engng.*, 6(4):287–300.
8. Madyarov, A., Prioul, R., Zutshi, A., Seprodi, N., Groves, D., Pei, J., and Wong, S.-W. (2021). Understanding the impact of completion designs on multi-stage fracturing via block test experiments. In *Proc. 55th US Rock Mechanics/Geomechanics Symposium*, Houston, TX. American Rock Mechanics Association.
9. Zoback, M. L., Zoback, M. D., Adams, J., Assumpcao, M., Bell, S., Bergman, E., Blümling, P., Brereton, N., Denham, D., Ding, J., Fuchs, K., Gay, N., Gregersen, S., Gupta, H., Gvishiani, A., Jacob, K., Klein, R., Knoll, P., Magee, M., Mercier, J., Müller, B., Paquin, C., Rajendran, K., Stephansson, O., Suarez, G., Suter, M., Udias, A., Xu, Z., and Zhizhin, M. (1989). Global patterns of tectonic stress. *Nature*, 341(6240):291–298.