Wireline Conveyed In Situ Stress Testing Applications In Western Canada

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Summary

In situ stress measurement, particularly of shales, is a key parameter in SAGD, gas storage and shale gas drilling and production/injection field and borehole design. Wireline or drill pipe conveyed in situ stress measurement methods offer an alternative to more traditional LOT methods.

Introduction

The state of stress in a shale or formation rock is useful in geomechanical characterization such as borehole stability and cap rock integrity for SAGD or gas storage design. There are three orthogonal principal stresses, one of which is the minimum, perpendicular to the maximum stress direction. Hydraulic fracturing is the most direct and accurate technique for measuring stresses at depth.

Theory and/or Method

Using a wireline or drill pipe conveyed packer system, a stress test can be performed to measure rock in situ minimum stress and other stress related properties. This is achieved by injecting borehole or other fluids between two inflatable packers to initiate and grow a fracture. By monitoring the initiation, propagation, closure and reopening of the induced fracture, in situ stress can be directly observed in real time from surface. A fracture that grows perpendicularly to the direction of the minimum stress and extends to four well bore radii will sense the far field stress.

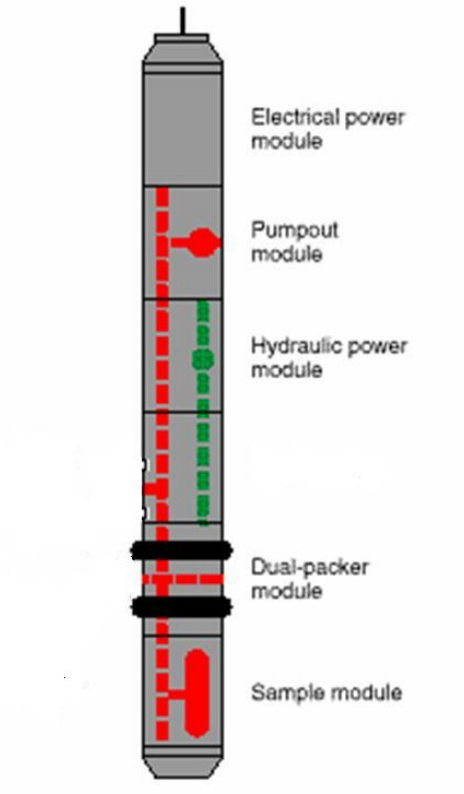

Figure1: Wireline stress testing tool configuration

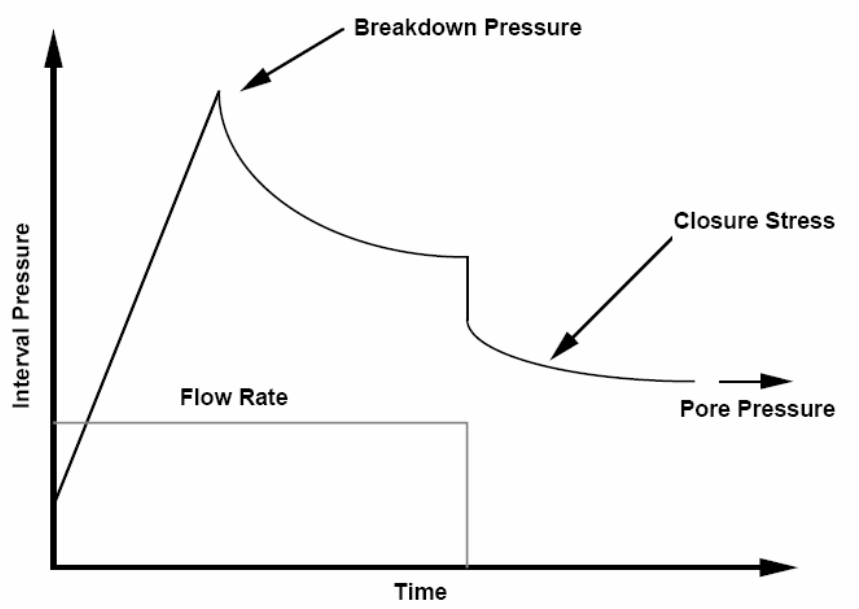

Figure2: Ideal time/pressure record for an situ stress test

Examples

Three shale cap rock wireline conveyed in situ stress test results will be presented and discussed. An example of one of the time/pressure sequences is shown in Figure 3.

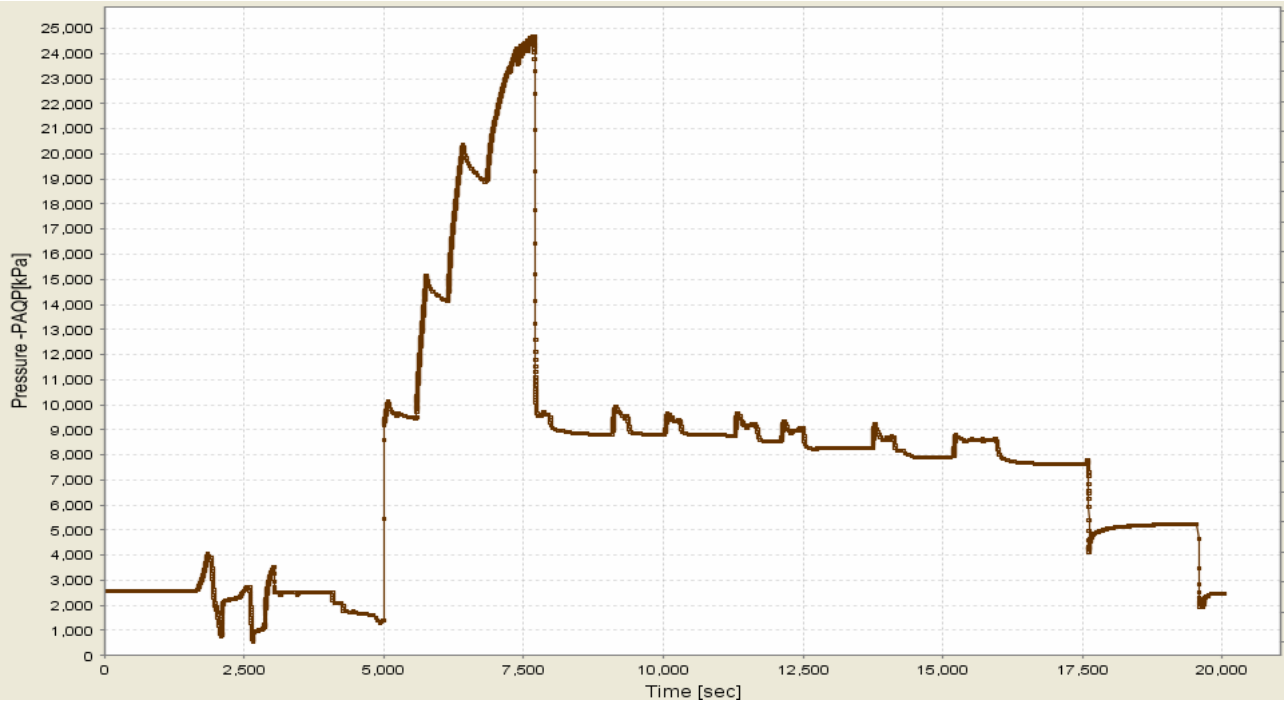

Figure3: Shale cap rock in situ stress test time/pressure results for SAGD cap rock in Western Canada.

Conclusions

Wireline conveyed in situ stress measurements have been validated by decades of experience worldwide. These principles can be applied to local field studies in the areas of SAGD, gas storage and shale gas production.

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