



SPE 110831

## Collecting Single-Phase Retrograde Gas Samples at Near-Dewpoint Reservoir Pressure in Carbonates Using a Pump-Out Formation Tester with an Oval Pad

Chris Jones, SPE, and Wandu Alta, JOB Pertamina-Hess Jambi Merang; Jorawar Singh, Bob Engelman, Mark Proett, and Bob Pedigo, SPE, Halliburton Energy Services

Copyright 2007, Society of Petroleum Engineers

This paper was prepared for presentation at the 2007 SPE Annual Technical Conference and Exhibition held in Anaheim, California, U.S.A., 11–14 November 2007.

This paper was selected for presentation by an SPE Program Committee following review of information contained in an abstract submitted by the author(s). Contents of the paper, as presented, have not been reviewed by the Society of Petroleum Engineers and are subject to correction by the author(s). The material, as presented, does not necessarily reflect any position of the Society of Petroleum Engineers, its officers, or members. Papers presented at SPE meetings are subject to publication review by Editorial Committees of the Society of Petroleum Engineers. Electronic reproduction, distribution, or storage of any part of this paper for commercial purposes without the written consent of the Society of Petroleum Engineers is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of where and by whom the paper was presented. Write Librarian, SPE, P.O. Box 833836, Richardson, Texas 75083-3836 U.S.A., fax 01-972-952-9435.

### Abstract

Collecting representative, single-phase retrograde gas samples from heterogeneous fractured carbonate formations is challenging, especially for cases in which the reservoir pressure narrowly exceeds the dewpoint. Conventional wireline probe/packer assemblies are undesirable in this situation because their small diameter probes increase the pressure drawdown, compared to other available intake configurations. Furthermore, the likelihood of establishing hydraulic communication with an open fracture or vug is low with a 1/2-in. diameter probe, compared to setting straddle packers spanning a 1-m formation interval. The straddle packer intake geometry reduces the drawdown pressure required to establish flow, thus maintaining the flowing pressure above the dewpoint and preventing the onset of unwanted condensation.

Inflatable straddle packers can be run with pump-out test tools, but they have temperature, pressure, and operational limitations. The new Oval Pad\* design, an elongated oval-shaped probe/pad assembly, possesses many of the advantages of dual packers without their limitations. Like a straddle packer, the Oval Pad tool is effective when testing thinly laminated and tight formations as well as fractured or vuggy carbonates. The oval shape enables the pad to encompass a significant vertical length of the borehole while establishing a pressure seal with the formation.

A retrograde gas reservoir is contained within the vuggy carbonates in the Jambi Merang area of South Sumatra. Here the reservoir pressure narrowly exceeds the dewpoint. Pressure must be maintained above the dewpoint during sampling operations to prevent unwanted phase separation. The RDT pump-out tester was fitted with Oval Pad and nitrogen-charged sample bottles to collect single-phase samples and to keep the phase intact until PVT properties can be analyzed in the

laboratory. These samples were necessary to determine laboratory PVT properties and to define a production strategy.

This paper presents the details and challenges of the successful collection of single-phase samples in this environment.

### Introduction

The Jambi Merang block is situated in the north of the south Sumatra basin (**Fig. 1**). The block was awarded in February 1989; and since then ten wells have been drilled, of which six were exploration and four were delineation (**Fig. 2**). The carbonate in the South Sumatra basin comprises build-ups on carbonate platforms along with the Marine Shale equivalent. The platform limestones are micritic and tight, while the build-ups form the reservoirs. Porosity is predominantly created by meteoric waters at the top of the build-ups, hence the traps are typically stratigraphically controlled by the diagenetically developed porosity distribution. The platform carbonates generally form on the shelf of the Sunda Craton with the build-ups developing on the platform. In the Jambi Merang block, the carbonate platform is isolated from the palaeo-coastal fringing platform limestones and is situated high on the Merang Block. On this isolated carbonate platform, there is a series of build-ups, one of which is Sungai Kenawang.<sup>1</sup>

Many operators have worked in this area, which is mainly a gas and condensate producer with the gas transported mostly to Singapore LNG Plants *via* undersea pipe lines and in west Java Power Plants. The carbonate reservoir is a 700-1000 ft thick retrograde gas reservoir with reservoir pressure very close to the dewpoint and with a bottom aquifer drive. JOB Pertamina-Hess Jambi Merang drilled two exploratory wells with the primary objective of enhancing formation evaluation. The evaluation program involved openhole logs, core analysis, and sampling. Cores were taken for laboratory studies of the carbonate reservoir rock. Openhole logs were run including standard resistivity, density, neutron, sonic, and spectral gamma ray in addition to electrical micro imaging.

Pressure testing, sampling, and fluid analysis were an important part of the formation evaluation program. Samples were required from the gas as well and single-phase gas sample was necessary for future production planning. It was anticipated that the dewpoint would be no more than 50 psi below the formation pressure. Obtaining representative gas and condensate samples is always challenging; but, in this case, the

\* A mark of Halliburton Energy Services