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1986/84. Measured values of pore pressures and leak-off pressures in the Bass Basin

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Abstract

The Bass Basin has been shown to have areas of unexpectedly high pressures found only so far in the Pelican region. This paper presents measured values of pore pressures and leak-off pressures obtained by various operators during drilling and testing of wells in the Bass Basin.

INTRODUCTION

When planning a drilling programme, in particular the associated casing design, it is advantageous to have values of pressures expected to be encountered, and knowledge of formation strength.

The main purpose of surface casing and the associated blowout preventer (BOP) system is to contain any well pressure that may be encountered whilst drilling to total depth or the next casing depth. Not only does this mean that the casing and BOP should be sufficient to withstand the pressure exerted upon them, but also the depth of the casing shoe should be such that the formation will not break down under the influence of this pressure.

To date, 27 wells have been drilled in the Bass Basin, and from the various tests performed, the values of pore pressure and leak-off values have been compiled so that further predictions can be made with a high degree of certainty.

It has been demonstrated by Winchester (1987) how these predicted values can be utilised for the design of surface casing strings.

THE BASS BASIN

The Bass Basin is a northwest-trending offshore intracratonic basin located in Bass Strait between Victoria and Tasmania. Water depths over the basin are generally between 30 m and 90 m, and it has an area of about 65 000 square kilometres. Geological development and exploration history are summarised in Etheridge *et al.* (1985), Davidson *et al.* (1984), and Brown (1976).

Within the *M. diversus* Zone of the Eocene portion of the Eastern View Group, an unconformity is recognised by some workers (Brown, 1976; Davidson *et al.*, 1984).

Since 1965, when the first well (Bass-1) was drilled, there has been sporadic drilling throughout the Bass Basin, to a total of 27 wells to date. There have been several strong shows of gas and liquids, with Pelican being the major accumulation. All the Pelican wells, and the adjacent wells penetrating the *M. diversus* Unconformity, encountered over-pressures.

Other than the Pelican and adjacent wells (Poonboon-1 and Narimba-1), few other wells penetrated the *M. diversus* Unconformity as deeply, if at all and the absence of overpressures elsewhere in the Basin cannot therefore be assumed.

PORE PRESSURES

The liberal use of wireline formation testers to obtain formation fluid samples and pore pressures has enabled pressure-depth plots to be made with a high degree of certainty. Production testing in two wells and a kick in well Poonboon-1 also enabled pressures to be determined.

With this data, pressure depth relationships have been drawn showing the overpressures encountered in wells in the Pelican area (fig. 1 to 5).

FORMATION STRENGTH

Many operators in the Bass Basin have performed formation strength tests after drilling out the casing shoe by pressuring up the formation either until 'leak-off' occurs or to a pre-determined limit if leak-off does not occur (limit test). The precise point of leak-off is unclear, but occurs at a value greater than fracture propagation pressure by a factor of 11%-15% (Breckels and Van Eckelen). It gives a value at which the pressure should not be exceeded, but in the case of inadvertent breakdown, gives no guarantee that propagation will not occur.

The various tests are shown graphically in Figure 6 and show remarkable consistency and agreement with the Breckels and Van Eckelen correlation.

CONCLUSIONS

1. Overpressures exist below the *M. diversus* Unconformity in the Pelican Pelican area.

2. Although not yet encountered, overpressures could exist elsewhere in the Bass Basin.

3. The Breckels and Van Eckelen correlation for leak-off pressure appears to be valid for the Bass Basin.

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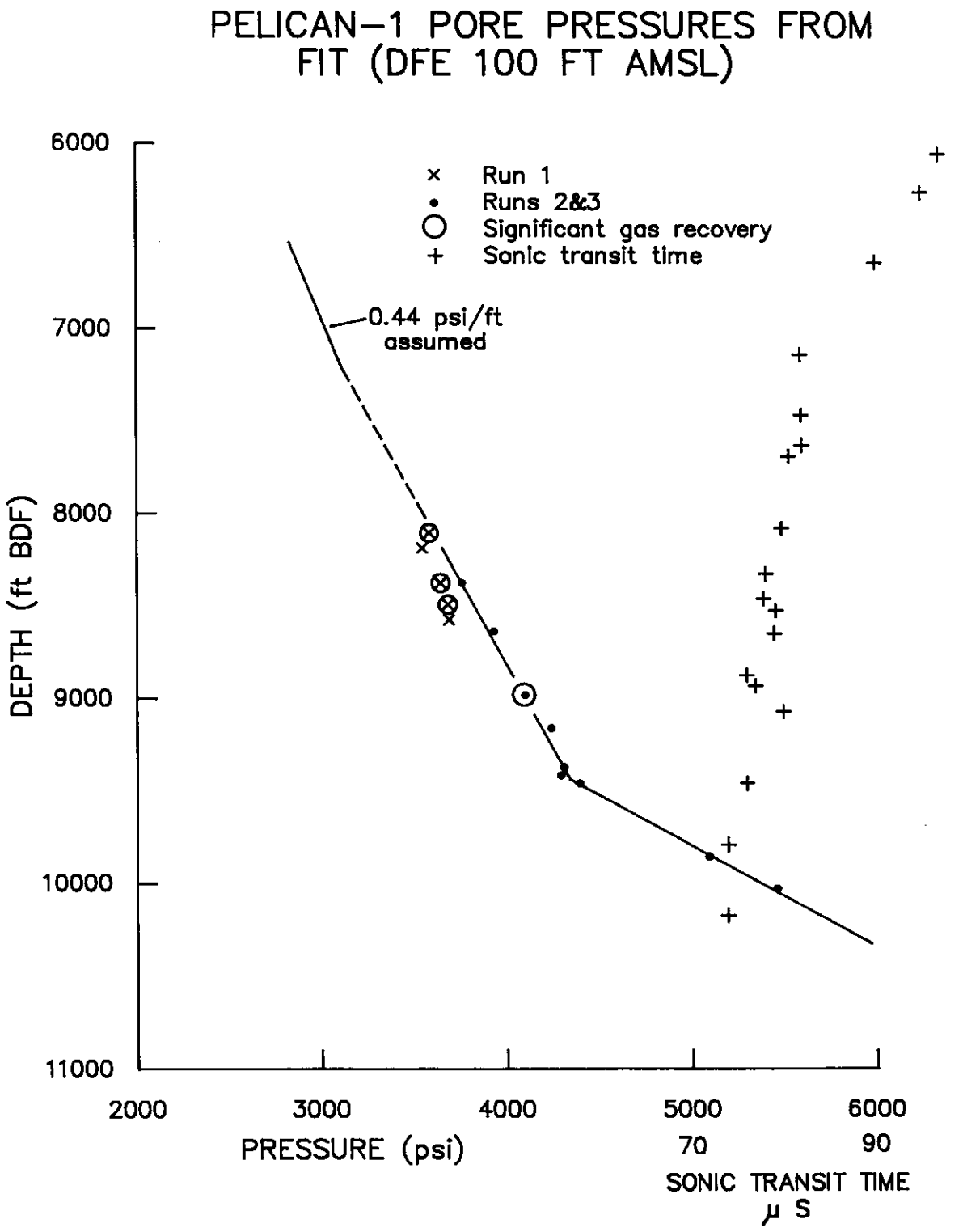
PELICAN–1 PORE PRESSURES FROM FIT (DFE 100 FT AMSL)
Run 1
Runs 2&3
Significant gas recovery
Sonic transit time
0.44 psi/ft assumed
DEPTH (ft BDF)
6000
7000
8000
9000
10000
11000
2000
3000
4000
5000
6000
PRESSURE (psi)
70
90
SONIC TRANSIT TIME
μ S
5 cm

Figure 1.

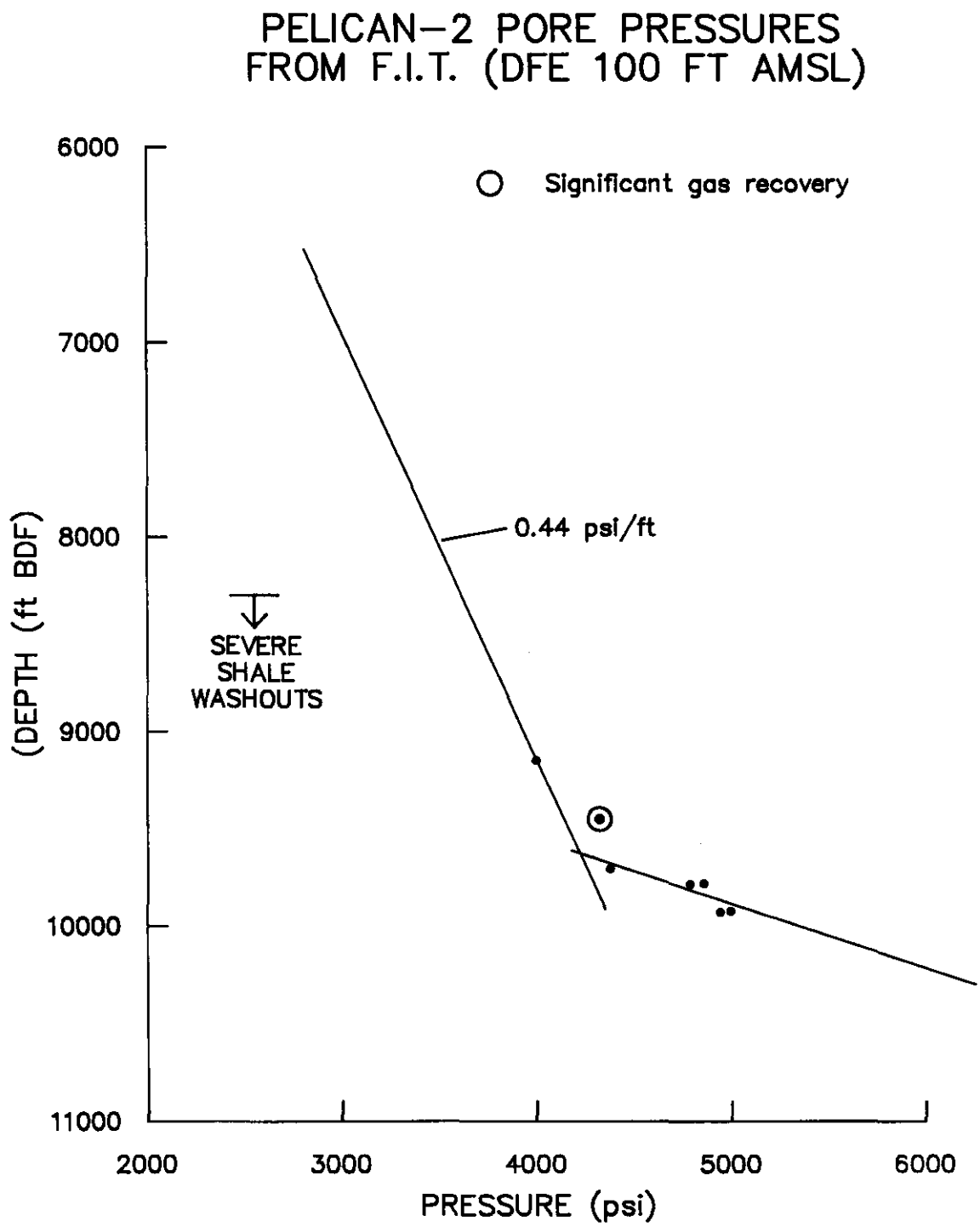
PELICAN–2 PORE PRESSURES
FROM F.I.T. (DFE 100 FT AMSL)
Significant gas recovery
0.44 psi/ft
SEVERE
SHALE
WASHOUTS
(DEPTH (ft BDF)
6000
7000
8000
9000
10000
11000
2000
3000
4000
5000
6000
PRESSURE (psi)

Figure 2.

5 cm

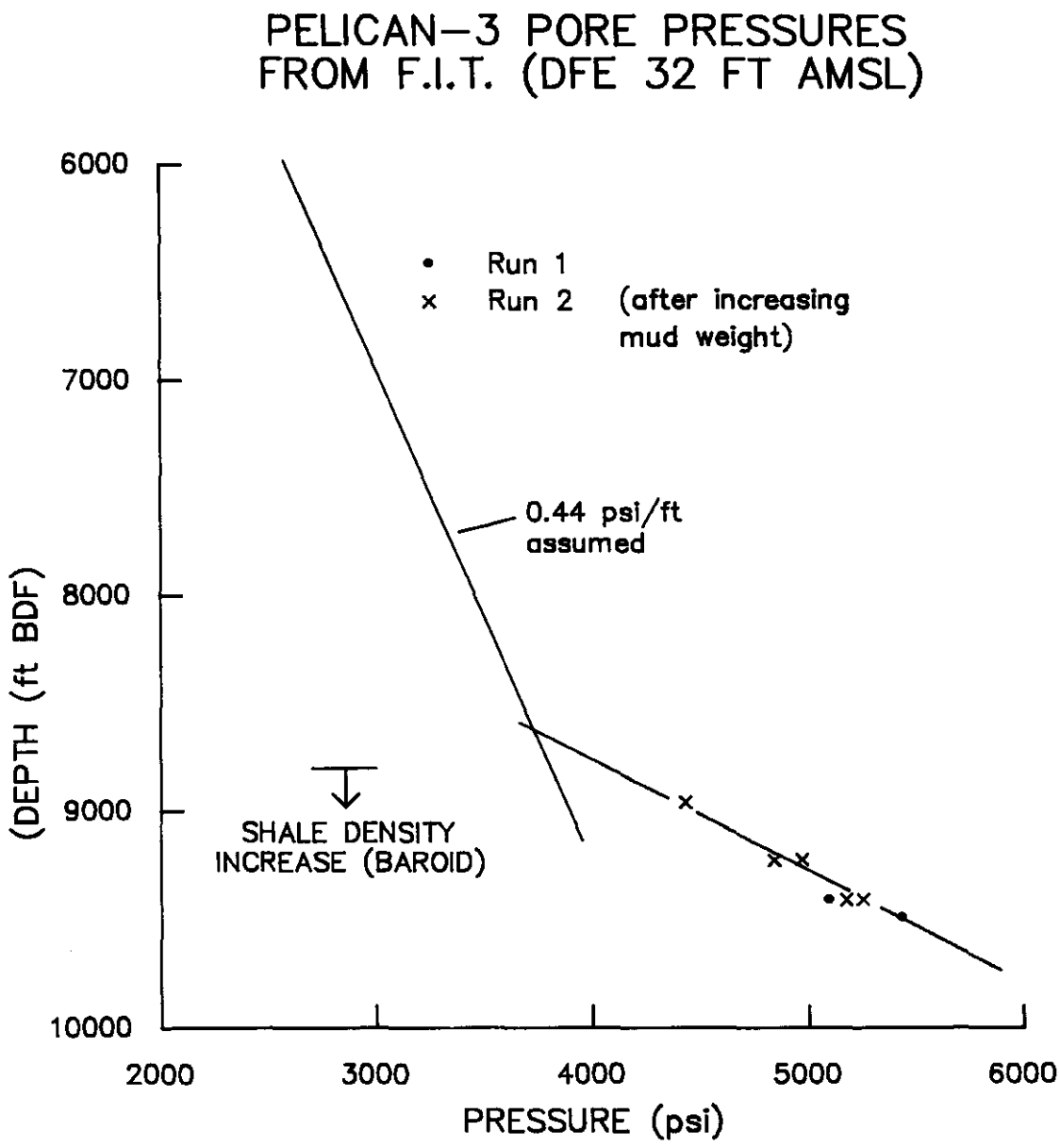
PELICAN–3 PORE PRESSURES
FROM F.I.T. (DFE 32 FT AMSL)
6000
7000
8000
9000
10000
(DEPTH (ft BDF)
• Run 1
× Run 2 (after increasing mud weight)
0.44 psi/ft assumed
SHALE DENSITY INCREASE (BAROID)
2000
3000
4000
5000
6000
PRESSURE (psi)

Figure 3.

5 cm

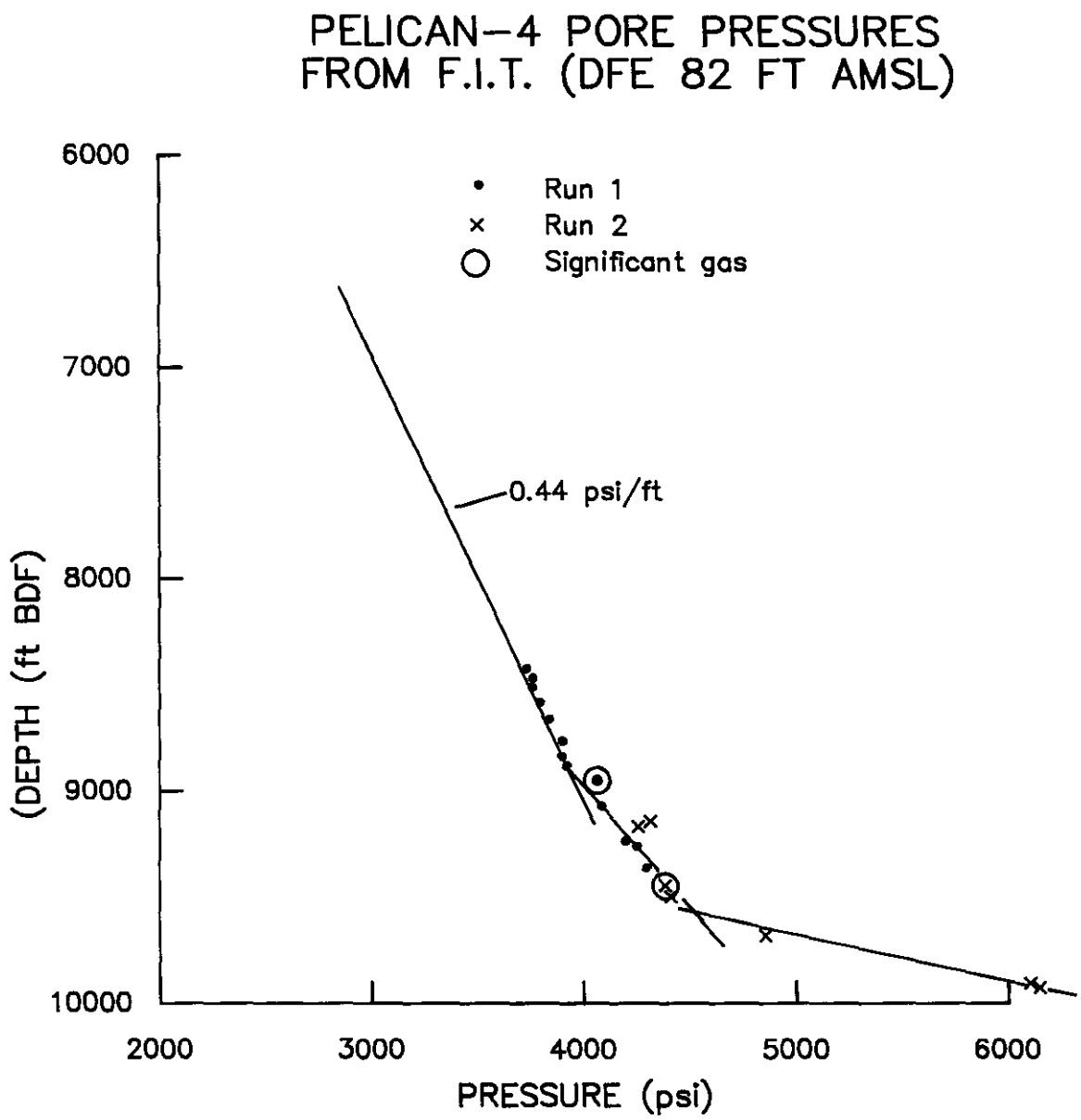
PELICAN–4 PORE PRESSURES
FROM F.I.T. (DFE 82 FT AMSL)
Run 1
Run 2
Significant gas
0.44 psi/ft
(DEPTH (ft BDF)
6000
7000
8000
9000
10000
2000
3000
4000
5000
6000
PRESSURE (psi)

Figure 4.

5 cm

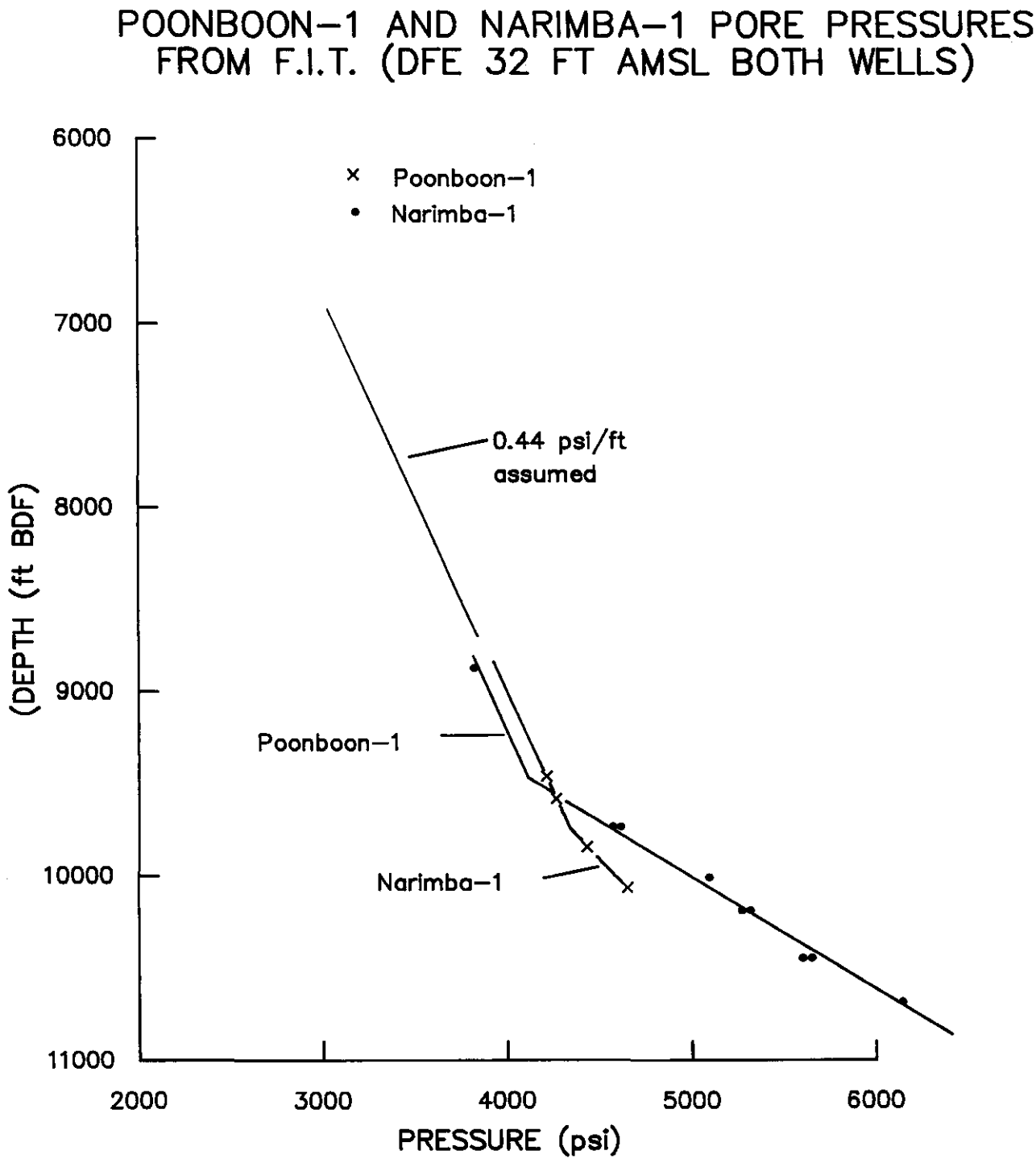
POONBOON–1 AND NARIMBA–1 PORE PRESSURES
FROM F.I.T. (DFE 32 FT AMSL BOTH WELLS)
6000
7000
8000
9000
10000
11000
(DEPTH (ft BDF)
× Poonboon–1
• Narimba–1
0.44 psi/ft
assumed
Poonboon–1
Narimba–1
2000
3000
4000
5000
6000
PRESSURE (psi)

Figure 5.

5 cm

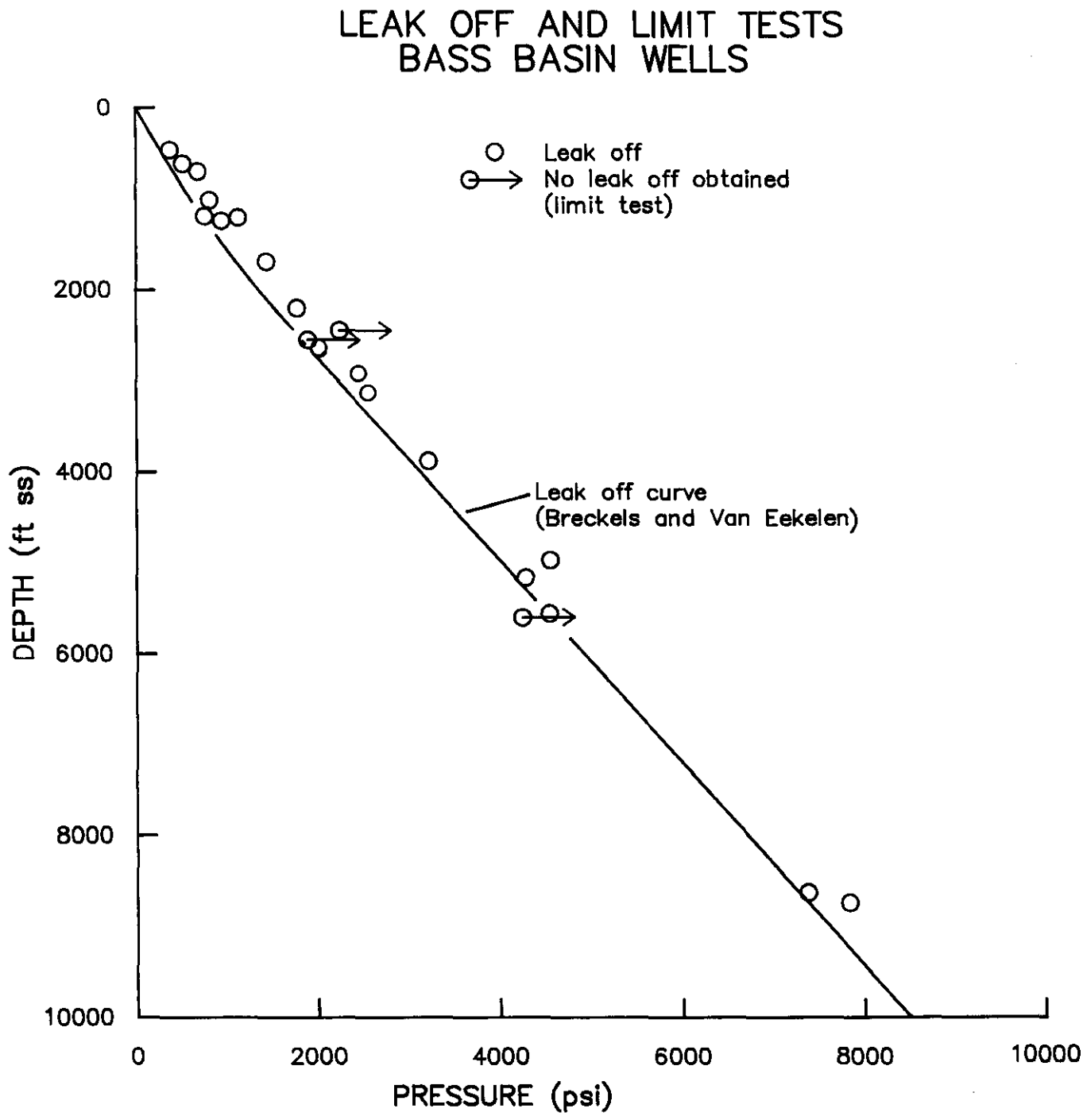
LEAK OFF AND LIMIT TESTS
BASS BASIN WELLS
Leak off
No leak off obtained
(limit test)
Leak off curve
(Breckels and Van Eekelen)
DEPTH (ft ss)
0
2000
4000
6000
8000
10000
0
2000
4000
6000
8000
10000
PRESSURE (psi)

Figure 6.

5 cm