# Overpressure Distribution and its Onshore Pattern, East Java Basin*

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Search and Discovery Article #11147 (2018)**
Posted November 19, 2018

*Adapted from extended abstract based on poster presentation given at AAPG Asia Pacific GTW, Perth, Australia, June 6-7, 2018


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## Abstract

The East Java Basin covers onshore and offshore areas of the northeastern most Java Island. This basin is an overpressured basin, proven by the presence of series of mud volcanoes, as well as several pressure-related drilling problems such as kicks, blow-outs, and high gas content. However, to date, there is no regional synthesis available related to overpressuring at the basinal scale. In this study, we attempt to make such regional synthesis aiming at understanding its distribution and characteristics of the onshore part of the basin (Figure 1). Our study shows that in the area experiencing severe erosion, the pressure regime is hydrostatic down to the basement. Overpressure is present in the area where erosion is less and the sedimentation rate has been relatively high. Our analysis reveals that the overpressure pattern and generating mechanism on the onshore part of the East Java Basin can be well explained by geological conditions.

In this study, we use pressure data measurement, drilling reports related to the presence of overpressure (eg. kicks, gas-cut mud, drilling breaks, and connection gas), and wireline log data to infer pore pressure conditions. We found that the top of the overpressure in the study area varies within the range of 630-1600 m below sea level. With respect to the shale overpressure pattern, overpressured wells in the study area could be divided into two general patterns: (1) lithostatic-parallel shale pressure profile (Shale Pressure Pattern-1/SPP-1), and (2) less than lithostatic-parallel shale pressure profile (Shale Pattern-2/SPP-2). The SPP-1 is distributed almost everywhere in the region, while the SPP-2 is limited to the southwestern part of the area.

The lithologic columns of SPP-1 wells indicate that the wells are dominated by shale with relatively thin sandstone and limestone interbeds. The sandstone and limestone interbeds may facilitate pathways for shale pressure bleed-off providing that the sandstone and the limestone are widely distributed and crop out at the surface. However, since the sandstone and limestone are quite thin, the shale pressure bleed-off is quite limited, thus resulting in lithostatic-parallel shale pressure profile. In contrast to SPP-1, in SPP-2, although the lithology is still dominated by shale, the sandstone and limestone beds are relatively thicker, and thus the shale pressure bleed-off is thought to be greater, as compared to SPP-1 wells. Therefore, the shale pressure in SPP-2 is lower than the SPP-1 wells (Figure 2).

The comprehensive analysis of overpressure generating mechanisms shows that the main cause of overpressure in the study area is disequilibrium compaction caused by rapid sedimentation. Clay diagenesis may start to contribute to overpressure at the depth where smectite starts to convert to illite, as indicated from XRD data. The depth range of the conversion in the study area is 1270-2120 m. In the deeper sections, hydrocarbon generation may also contribute to overpressure magnitude.

The results of XRD analysis also reveal that there are two compaction lines in the study area: (1) mechanical compaction/smectite compaction trend (MC), and (2) chemically-enhanced mechanical compaction/illite compaction trend (CEMC). The depth range of CEMC is 1250-1750 m. The temperature range where the conversion takes place is 72.6-94.57$^{o}$ C.

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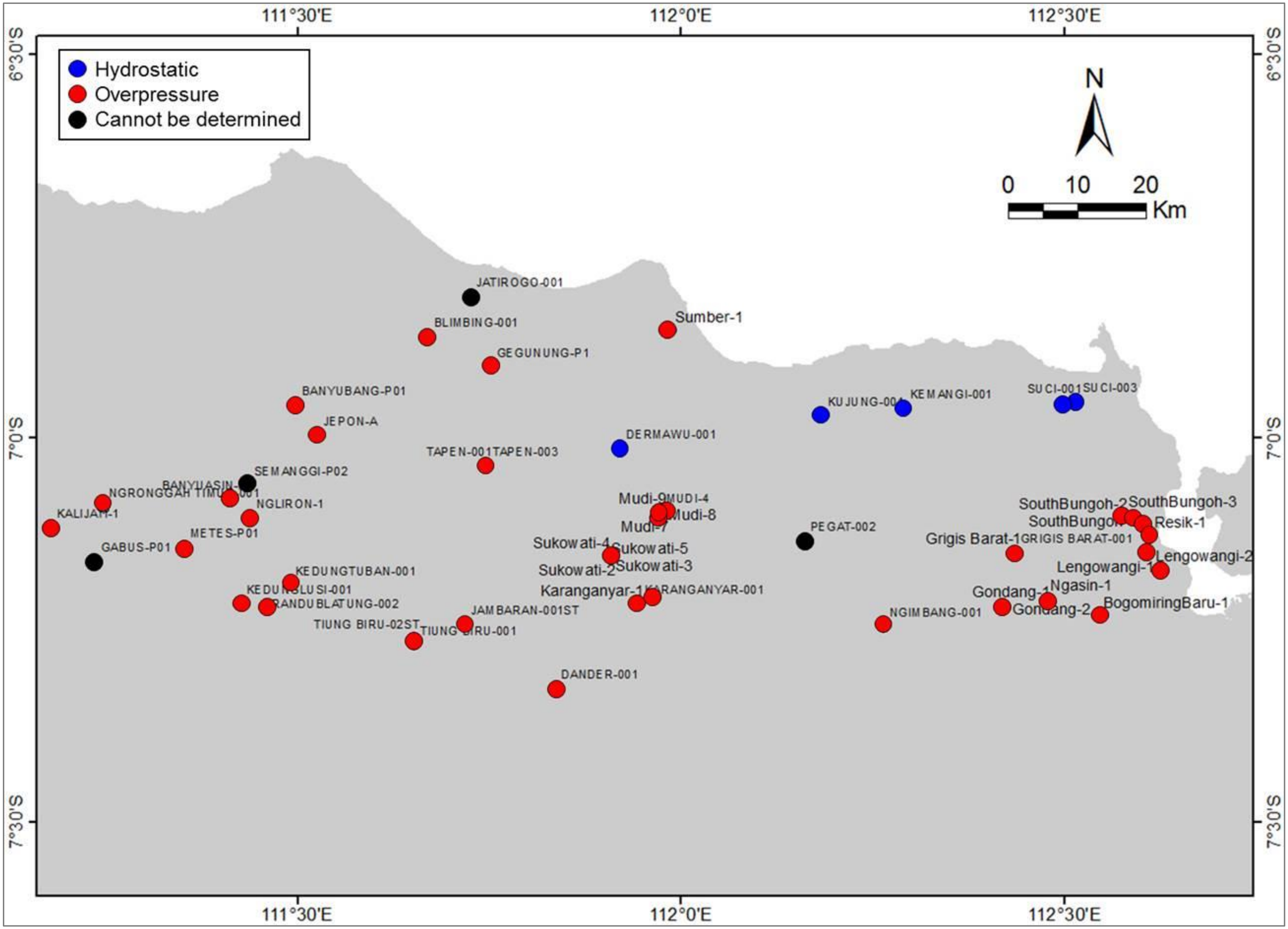


Figure 1. Map of onshore wells at hydrostatic pressure and overpressured.

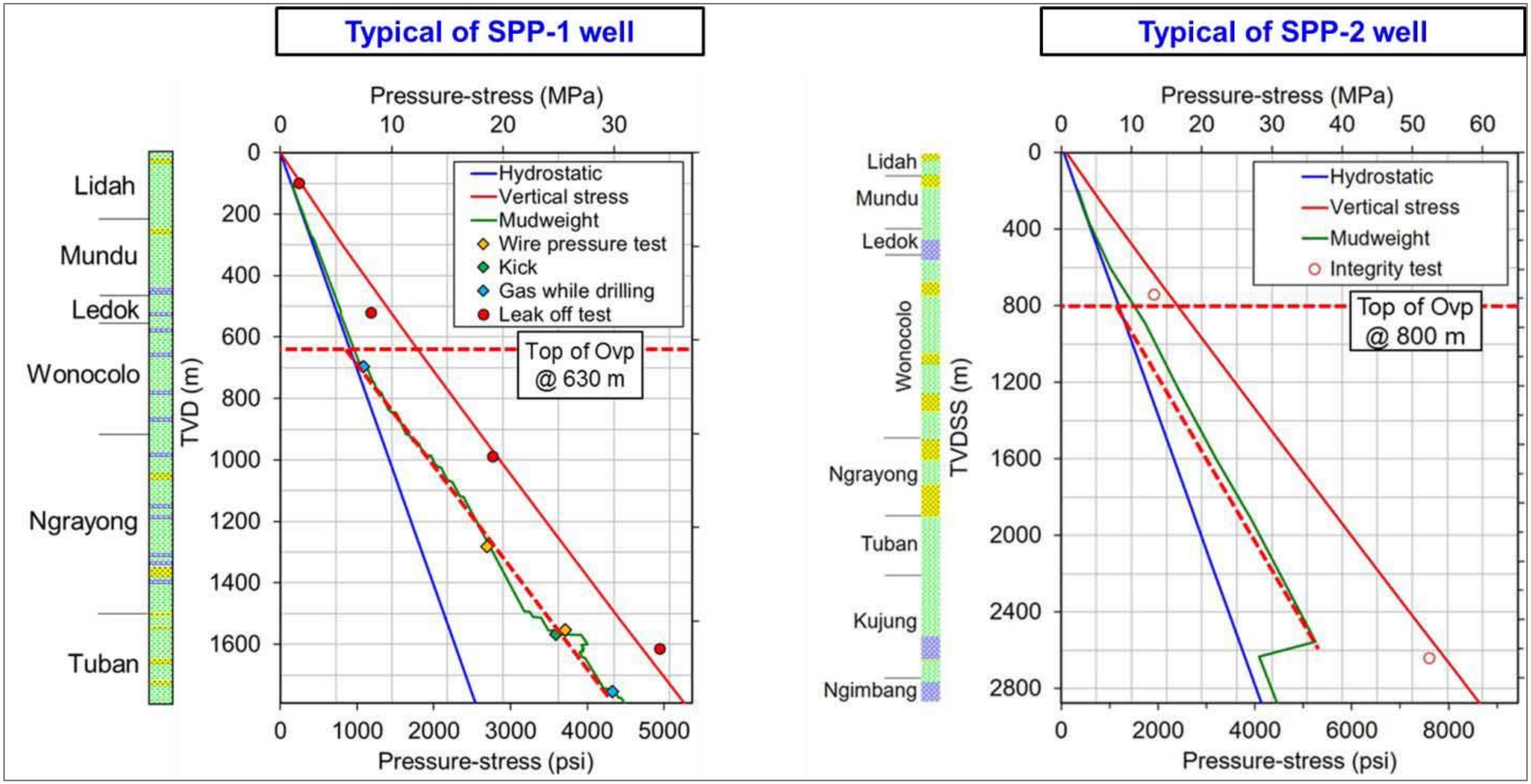


Figure 2. Typical pressure profile and lithologic column of SPP-1 and SPP-2 wells.