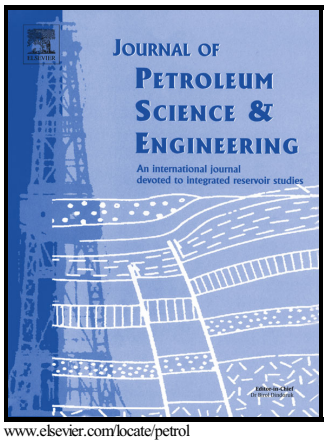

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Pressure Gradient Prediction of Time-Dependent Drilling Fluids and the Effect of Acceleration

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ABSTRACT

It is common that water-based drilling fluids exhibit thixotropy, which is defined as the change of the fluid rheology with of time. This phenomenon occurs due to the build-up and break-down of the clay particle structure as shear rate is varied. The drilling fluid structure provides the ability of the mud to suspend and transport the drilling cuttings during drilling operations. Several time-dependent rheological models have been developed to predict the thixotropic behavior of drilling mud. However, this paper aims to propose and validate a simplified model on the basis of the time-dependent rheological model proposed by Tehrani and Popplestone (2009) and coupling it with the momentum equation to predict the pressure gradient of drilling fluid in pipes. In addition, a separate evaluation of the momentum equation is carried out to investigate the effect of the accelerational pressure gradient component on the magnitude of the total pressure gradient. Rheometer testing was performed to obtain measurements required for the proposed model. In addition, fluid flow experiments were performed in a testing flow loop where experimental data was acquired to validate the model pressure gradient predictions, and determine the significance of accelerational pressure component. The results of this work will improve wellbore pressure prediction. This will result in more efficient, economical and safe drilling operations.