AAPG Datapages/Search and Discovery Article #90319 ©2018 GEO 2018 13th Middle East Geosciences Conference and Exhibition, Manama, Bahrain, March 5-8, 2018

Comparsion of Static and Dynamic Moduli for Variuos Oil and Gas Reservoirs in Saudi Arabia

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ABSTRACT

Rock mechanical properties are pre-requisite to understand many processes in petroleum engineering. The stress-strain relationship of a rock describes the way the formation's framework of granular materials respond to the applied load. This relationship is determined in the lab to obtain static mechanical properties or obtaining the same through the use of dipole sonic logging. One of the most critical parameters is the static rock mechanical properties such as Young's modulus and Poisson's Ratio as they are input parameters in various studies related to reservoir simulation, wellbore stability, sanding tendency, hydraulic fracturing, surface subsidence and reservoir compaction. Due to the limitation of available core samples, log-based rock mechanical properties are usually used in solving these petroleum engineering problems. However the log mechanical properties (the dynamic properties) should be calibrated with lab-based properties (the static properties) before evaluating any rock-mechanics related problems in petroleum engineering. Several wells from different reservoirs in Saudi Arabia have been studied where static and dynamic rock mechanical properties are available to determine the specific static-dynamic correlations. It was found that these correlations are formation-type dependent and therefore establishing a meaningful correlation requires testing representative core samples that cover all fancies of a given reservoir. The results showed that the developed correlations indicate a good difference between the static and dynamic Young's moduli while the difference is minor between the static-dynamic Poisson's ratios. This paper introduces a new factor being the formation type when a static-dynamic correlation is developed for a give petroleum-engineering study. The detailed methodology of developing these correlations is discussed in details. The extrapolated static mechanical properties from a given dynamic properties log is presented. The procedure of obtaining mechanical properties from a non-cored well based on an established correlation from a cored well is provided.