OPTIMAL SWELLING MODEL IDENTIFICATION UNDER THE INFLUENCE OF REACTIVE PHASE OF DRILLING MUDS

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The swelling model of clay formations of well walls depends on the type of reactive fluid cations, including drilling muds, with which the wall clay interacts. For this reason, it is necessary to recognise the swelling type of a clay formation under the influence of various cations. The drilling technology should take into account the time it takes to achieve maximal swelling of a particular clay in a particular environment. This would ensure that action is taken within a limited time, before the swelling has reached its maximal values. In this way, the Tortonian clays have produced a lot of reservations during the drilling process of many deep and very deep wells in Albania. According to the identified models of swelling, it appears that they have a swelling of "zero" time, which means that as soon as they come to contact with the reactive environment they swell instantaneously.

Formations of swelling clays of these walls, even within a single well, behave differently in different depths towards active fluids which contain cations. This fact should be taken into consideration during the selection process of the chemical content of drilling muds used in a particular well.

The necessary time for maximal swelling of an ingredient of drilling mud (clay, polymer, filler etc.) is often relatively long. If a clay, polymer or another drilling fluid ingredient which has not yet reached maximal swelling is introduced to a porous layer of oil-gas, this will modify their tensioned conditions and consequently, supplementary tensions are created. If the ingredients have not completed the full swelling cycle, they will act as "blocking" agents during the continuing swelling process to the productive layer of oil, gas and retaining water.

The study argues the identification of the swelling model of clays under the influence of the active phase of reactive solution, which are exposed to the walls of the well.

The swelling model is identified based on the kinetic laws of swelling. The linear swelling model is based on the law $KdV/dT + V_0 = V_\omega$ (where V is the volume at the moment T, while V_0 and V_ω are at time T = 0 and ∞, respectively; K is a kinetic parameter, the time of swelling), and its linear form $B = CT$ (where $B=\ln[(V_\infty-V_0)/(V_\infty-V)]$ and $C = 1/K$).

The tests were carried out under the influence of different reactive solutions, which have simulated the filtration of drilling fluid used most often in the drilling technology. The correlation coefficients are evaluated and the most confident regression equations of the swelling models are made evident (Table 1). The swelling model is related to the specific structure of the clay. Structural specifications of clays are carried out with the techniques XRD, DTA, IR, CEC and TEM and are part of this study.

References

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Table 1:

Type of clay and reactive solution	Regression equation	Correlation coefficient
Clay of Divjaka well, exposed to distilled water	B=2.7705+0.010T	0.935
	B=2.824exp(0.00277T)	0.925
	B=0.101+0.83ln T	0.997
Clay of Divjaka well, exposed to solution 1% $CaSO_4$ ½ H_2O	B=0.335Texp(0.217)	0.943
	B=0.065+0.219lnT	0.862
	B=0.550exp(0.00093T)	0.981
Clay of Divjaka well, exposed to solution 1% $CaCl_2$	B=10.5251+0.288T	0.743
	B=4.731Texp(0.435)	0.998
	B=1.233+5.416lnT	0.884