

STUDIES OF STRESS FIELD PARAMETERS BY THE DATA FROM VERTICAL SEISMIC PROFILING (VSP)

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The paper describes a new method and results of studies of a present stress field in deep scientific wells drilled in the European part of Russia. It also makes a comparative analysis of existing methods. The development method for determination of orientation of the principal stresses is based on analyzing specific features of polarization of compressional waves described within a theory of gyrotrope media. The proposed method for determination of stress magnitudes is a seismic-acoustic analogue of the method of destruction and it is based on evaluation of deformation and difference of elastic modules of the rocks in situ in a zone which is effected by a drilling mud and core measurements. Based on VSP data orientations of maximum horizontal stresses are $N137E \pm 13$ for the Vorotilov well, $N134E \pm 14.8$ for the Ural well and $N13E \pm 12$ for the Tyrnauz well, and corresponds with the borehole televiewer data (C.Barton, D.Moos, S.Hickman - U.S.A., F.Roth, K.Huber, H.Baessler - Germany and specialists of Nedra - Russia). Horizontal stresses magnitudes are characterized by significant variations with depth which are caused by local and regional factors and which change from 5 to 45 MPa in the Vorotilov borehole, from 15 to 100 MPa in the Ural borehole and from 50 to 300 MPa in the Tyrnauz borehole. Reliability of obtained estimates is proved by observations conducted in the Vorotilov and Ural wells. The main conclusions about a present stress field in the intervals under study taking into account repeated levelings and data on focal mechanisms are: the East-European Platform - SVSHSh, the Middle Urals - SHSVSh, the Northern Caucasus - SHShSV. The obtained data were used to develop mathematical models which allowed to prove that the proposed method as well as a method of borehole elongation have high resolution. VSP data can be used to determine orientations and magnitudes of constituents of a contemporary stress field without additional special requirements while doing the work.