O17-1	TRENDS OF STUDY OF OVERPRESSURE ON SEISMIC DATA

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Over-pressures is an important geological problem in many regions of the world. Knowledge of over-pressure is necessary to drill boreholes, study of hydrocarbons migrations, formation of oil and gas fields, etc. The most effective method to estimate rock's conditions before drilling is a seismic prospecting. The zones of over-pressures are frequently characterized by an abnormal intense condition of rocks, abnormal porosity, density and other. These factors are the physical preconditions for over-pressure prediction from seismic data.

The first researches on over-pressure prediction from seismic data were put into practice in a Gulf of Mexico (1968) [1]. These researches were carried out for 1D of a case and as initial data were used interval transit time (return size of velocity). The first successes achieved by Pennebaker in 1968 inspired other researchers to prediction of over-pressure in different regions too (Reynolds, 1970; Louden, 1971, Mexican Gulf; Aud, 1974, Texas) [2,3]. The geography of over-pressure definitions became more wider what had allowed also to reveal restrictions of used methods. It was established that while prediction of over-pressure it is necessary to take into account genesis of over-pressure, a lithological structure of geological section, presence steep of geological borders, faults, etc. (Aud, 1994; Fertl, 1976). Therefore in different geological regions use of different methods of an estimation the over-pressure is necessary. Method suggested Eaton [5] provide the best results in under-compacted shale-dolominaut contexts. Method of normal compacted shales curves works very good in geological section contains equal quantity of shale and sand [7]. For both types of geological sections containing plenty of shales or sand the method of equivalent depth shows rather acceptable results [7]. For carbonate sections use of a compression curve method is expedient [8].

Basic seismic parameter used for over-pressure prediction is interval velocity. The interval velocity was used by like Pennebaker, Reynolds, Aud [1,2,3] and authors of the last years [5,6,9]. First researchers already specified on that to interval velocities is necessary to produce the special requirements [3,6,9,11]. The prediction of over-pressure should be carried out on the basis of detailed study of seismic velocities.

In 1978 Italian experts from AGIP the carried out researches in Po river valley (Adriatic basin) and have offered the use of derivative of interval velocities: a ratio of interval velocity to normal [10]. The similar approach was used in 1982 in Nigeria and also in northwest Russia (Murmansk, 1990) [12].

Perspective direction is use of dynamic parameters of seismic signal for forecast over-pressure [14]. It has been established, that over-pressure zones influence attenuation of a seismic signal, amplitude of waves and frequency.

The influence of covers of over-pressure zones on amplitude of seismic waves was specified in works [6, 13]. However unfortunately up today such researches have not had a wide circulation. And the reasons are connected to ambiguity of interpretation of dynamic parameters.

The development of methods of over-pressure prediction is closely connected to development of a seismic technology. Prediction models constructed by Pennebaker and Reynolds were for 1D cases [1,2], but from the end of 70s 2D models have applied for over-pressure prediction [5,6,8,9,10,11]. Since 90s creation of 3D models became more often [9,15], but even now usage of 1D models are taking place too [5].

The results of over-pressure prognosis are used by drilling engineers very frequently, therefore the value of any prognosis grows if the researches are finished by the specific recommendations for realization of drilling: optimum mud density, value of fracture pressure, casing design, etc.

[1,3,4,6,10,12]. Accuracy of predicted over-pressure values, mud density, position of abnormal pressure covers by the first investigators (Pennebaker, Reynolds, other) was reached 25 - 30 % and sometimes 50%, in the researches of the last years these parameters are improved up to 8 - 12 % [6,12].

The special importance is given for use of computers and development of software for over-pressure prediction from seismic data. The first attempts in this direction were made in the papers [8,10,11]. With the development of computer technology use of computer engineering has been extended for over-pressure prognosis [6,9,14,15]. However despite existence of separate computer developments till now we still do not have integral commercial software capable effectively work with data on various geological sections and with use of a wide set of seismic parameters.

Conclusions

Modern level of researches of prediction allows to define over-pressure with an average statistical error 8-12 % (depends on the region, depth, System of accusation, etc.), to build 1D, 2D, 3D overpressure models and to give specific recommendations for drilling. Basic parameter used for these type of researches is an interval velocity. Use of dynamic parameters of a seismic signal still does not have a wide application. Very promising is the attraction of AVO analysis, but this direction has been bypassed undeservedly by attention of over-pressure experts.

About prospect: in future it would be necessary to expect the occurrence of commercial software capable to predict over-pressure, technological parameters of drilling and to determine correct construction of well for any types of geological sections on a wide spectrum of 2D, 3D, 4D and even multicomponent seismic survey data.

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