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The Research of System of High Resolution Data Acquisition Equipment

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Abstract: - In the detection of thin oil reservoir and oil and gas development fine geologic description, seismic exploration technology is more and more widespread attention and universal application, while the fine oil exploration and development on the accuracy of seismic exploration and put forward higher requirements. So the key problem to detect the thin oil reservoir layer is to improve the resolution of seismic exploration technology, study on the resolution of seismic exploration, we must first study strata absorption and attenuation effect. Because of the absorption of seismic wave amplitude, in the process of communication frequency, band width decreased gradually, unable to meet the demands of high resolution seismic prospecting. So the study of high resolution data acquisition system is very meaningful.

Key words: *- seismic data acquisition, high resolution seismic exploration, forward modeling*

I. INTRODUCTION

In the field of oil and gas exploration and development, the role of seismic exploration technology to any other exploration methods cannot be compared. It gets high attention. Seismic exploration is a large system projects, including three important aspects. The first is namely seismic survey field data acquisition, the second is seismic data processing and the third is integrated interior geological interpretation of seismic data. In these three areas, the seismic data acquisition is extremely important basic link. if it is out of the question, it cannot guarantee achieve high-resolution seismic exploration,

According to the seismic parameters of north area, establish the optic layer absorbing media model. Select the 200Hz main frequency Ricker wavelet from shallow to deep seismic reflection wave calculation, calculation of absorption and attenuation properties of formation. According to the attenuation of main amplitude and the mathematical model of the original seismic reflection wave formation, design spectrum equilibrium filter, is used to compensate the attenuation due to earth's absorption. Through the computer simulation analysis shows that, the time from 0.5s to 3.0s, the actual seismic vertical resolution of 7.4 ~ 45.7m, equalization filter after the vertical resolution of 3.6 ~ 17.4M, the relative absorption of stratum resolution up to 64.43 ~ 36.42%.

Design spectrum equilibrium filter theory is given in this paper is reasonable and feasible, which can effectively compensate the high frequency attenuation of formation, the resolution of seismic exploration increase. This has an important guiding significance for high resolution seismic data acquisition.

Formation of high-frequency attenuation effects are the main cause of high resolution seismic exploration. In order to obtain high resolution seismic exploration, the instrument must be recorded before the formation attenuation compensation. Improve low-cut filter cutoff frequency (or use the high-frequency detector) is a 1990s had adopted a way to improve the resolution, and its essence is through the suppression of low frequency to high frequency of relatively prominent, can be improved the main frequency of the recording signal. But it will make that the signal band width becomes narrow, leading to the relative bandwidth of signal becomes narrow. It has no effect to improve the resolution of seismic exploration.

The effect of vortex detector application is not obvious, because it increases the sensitivity with frequency only 6dB / oct increase rates, which cannot make up much ground to absorb high-frequency signal attenuation. Vortex detector sensitivity is smaller than conventional detectors 50 times, which is undesirable.

II. THE CHARACTERISTIC OF RESOLUTION

2.1 Earthquake recording

Characteristics of seismic records and the column cross-sectional view or logs cannot be one by one. The well with 1000m length can often be divided into hundreds of thin layers, and one second records and only a few dozen peaks and dozens trough, and one second corresponding thickness often exceeds 1000m. Therefore, each peak or trough is necessary to the result of the combined effects of the reflected wave multiple interfaces, by no means represent a particular interface.

Figure 1 is a simple process of making synthetic seismic recording. The R in left of figure contains 15 reflection coefficient. On the way from 1 to 15 of 15 sub-waves, their time, polarity and amplitude correspond to of 15 the

reflection coefficient of R. It can be seen at a time in the range of wavelet continuation, it has a plurality of reflection coefficients, and each wavelet in time significant overlap each other. The right of graph, SS is a synthetic record, is the result of the addition of 1 to 15. Figure 1 can draw the following conclusions:
(1) Generally, from the record cannot identify the location of the reflecting interfaces, cannot get how much reflection interface.
(2) Half cannot be seen from the record wavelet shape.
(3) Recording on a crest or trough half do not represent a reflective interface.

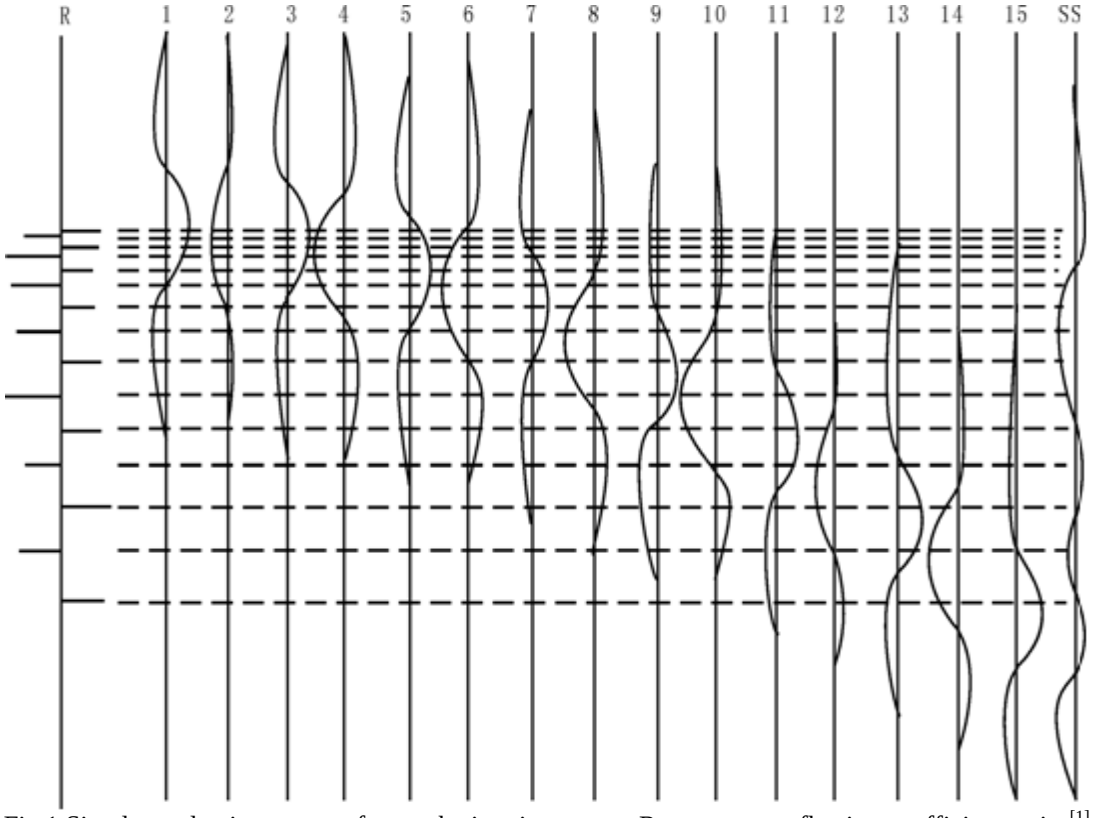
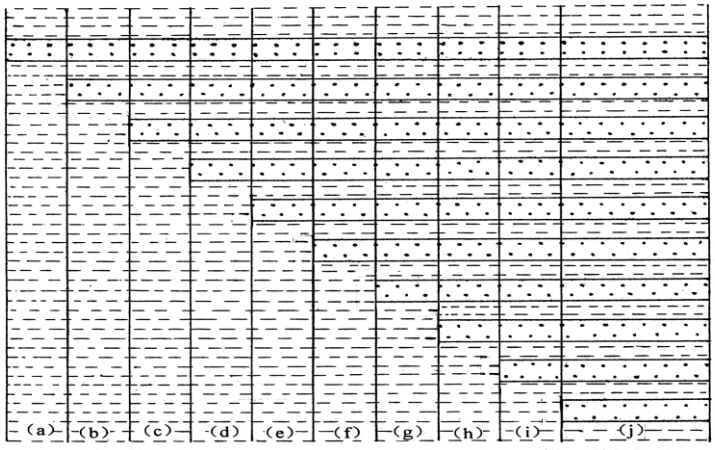


Fig.1 Simple production process for synthetic seismogram, R represents reflection coefficient series[1]

2.2 Earthquake model

The thickness of a single layer of 0.5ms (Figure 2 (a) - (j)), sand overlap with 1 to 10. The reflected wave amplitude is 1.3, 4.3, 5.8, 6.8, 7.1, 6.9, 6.3, 5.7, 5.3 and 5.0. Its characteristics are laminated with increasing number of sandstone. Sandstone cumulative thickness increases, the amplitude of the reflected wave also increases, when the entire substrate thickness to one-quarter wavelength, the amplitude of the reflected wave reaches the maximum amplitude reduction after small and gradually stabilized.



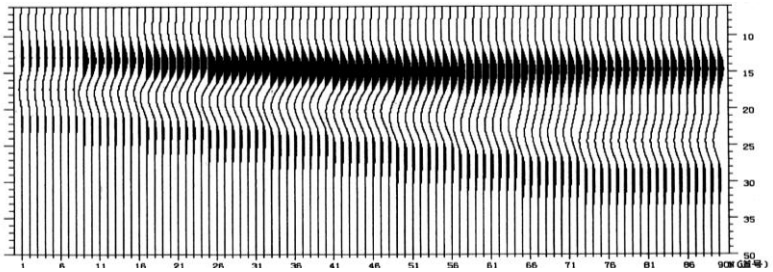


Fig.2 Number laminated of sandstone and seismic reflection feature comparison

III. PRINCIPLE OF SEISMIC DATA ACQUISITION INSTRUMENTATION

3.1 The systems of centralized seismic data acquisition instrumentation

In the data collection process, the entire signal processing is: seismic signal picked up by the detector, the ground vibration signal into an analog voltage signal, the signal through an analog signal transmission to large line filter to filter out common mode interference and high frequency interference, the signal is supplied to the filter after the low noise preamplifier, in order to facilitate the subsequent filtering. The amplified signal is sent to the high-pass filter, low pass filter, notch filter to simulate the filtering process. Finally, after each one sub-multiplex channel signal samples to send to send instantaneous floating-point amplifier (IFP) variable-gain amplifier, and the analog signal into the IFP adjusted 15 Successive approximation type A / D converter the analog switch. IFP produced 3 gain yards and 15 A / D converter bits into the formatting circuit arrangement in accordance with a predetermined format, the results of choreography into the digital tape recording[2].

3.2 The systems of distributed telemetry seismic data acquisition instrumentation

The centralized control type digital seismograph geophones connected via an analog signal line and the acquisition system. With the deepening of the application of computer technology in the seismograph, the people of the data acquisition system amplifiers, filters, A/D converter, the data transfer control logic and overall control complete with CPU. The collection station to prevent the detection point, each gathering station with digital signal lines or wirelessly connected to the host with the central record, when the rational combination between the collection station and record the host, can constitute a distributed data acquisition system.

IV. SEISMIC DATA ACQUISITION INSTRUMENTATION SYSTEMS

4.1 Principia Mathematica spectrum equalization filter

To absorb the formation of attenuation compensation, the best way is to set the frequency attenuation properties and characteristics of the formation opposite the filter in the instrument preamplifier circuit - Spectrum filter, its transfer function should be[3]

$$H(f) = 1/Dn(f) = e^{0.1122f \sum_{i=1}^{n} v_i^{-2.2}}$$

4.2 Spectrum equalization filter parameters and mathematical model

According formations known attenuation constant K constant C, C value calculated from the differential spectrum equalization filter constant, statistical calculation results in Table 4-1. Time from 0.5s ~ 3.0s, to determine the spectrum equalization filter designed amplitude spectrum and phase spectrum function in Table 1[4].

Table 1. Derivative constant statistics of frequency spectrum equalization filter

Depth t_0/s	c	$D_{12}10^5$	$D_{34}10^5$	$D_{56}10^5$
0.5	0.0209	– 0.5532	– 0.0922	– 0.0368
1.0	0.0358	– 1.6232	– 0.2705	– 0.1082
1. 5	0.0443	– 2.4855	– 0.4142	– 0.1657
2. 0	0.0496	– 3.1158	– 0.5193	– 0.2077
2. 5	0.0524	– 3.4775	– 0.5795	– 0.2318
3.0	0.0544	– 3.7481	– 0.6246	– 0.2498

V. CONCLUSIONS

The research of resolution seismic, first, we must examine attenuation effect of formation. In this paper, theoretical analysis and mathematical modeling of formation attenuation, the general trend is to follow its

absorption decay exponentially, travel time of seismic wave longer, frequency higher, and more severe attenuation. Important parameters reaction formation attenuation characteristic is the quality factor, attenuation and absorption coefficients, which are linked to a clear theoretical and empirical longitudinal wave velocity of seismic waves.

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