Comprehensive Technology for Complex Targets Research with Electromagnetic, Gravity, Magnetic and Seismic Data and its Applications

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ABSTRACT

The conglomerates developed in the piedmont areas would form a "velocity trap" for seismic data processing vulnerably, which makes it difficult to set up an exact velocity model and affects the reliability of the interpreted traps. Gravity, magnetic and electromagnetic (EM) responses, especially EM data, are sensitive to the existence of conglomerate masses. EM data can apparently indicate the existence of the conglomerate mass, but due to the volume effect, we can not interpret the conglomerate layer in more details along the vertical direction only with EM data. Seismic data can't identify conglomerate,but it gives more details, which make it possible to identify the strata and trace it. EM and seismic data complement each other. This paper mainly introduces 3D inversion and interpretation technologies with gravity, magnetic and EM data, and a software platform which realize joint interpretation of gravity, magnetic, EM, seismic and drilling data and so on. The mode of comprehensive interpretation was developed from qualitative comparison to joint fine description. The conglomerates are developed widely in D area, T basin shown by the data of drilling and outcrops, but the distribution of them is not clear. The uneven distribution of the conglomerates with high velocity affects the seismic imaging of deep structures, which results in an inaccurate interpretation of the deep structures, and even results in different understanding of the basic structural model. Therefore, to predict the distribution of the conglomerates and its lithology and lithofacies accurately, and to obtain an accurate velocity model is an urgent problem to be solved for the exploration in the piedmont areas. The accurate distribution of conglomerates was obtained by using 3D gravity, magnetic, EM and seismic data. The velocity model obtained is used in the pre-stacking depth migration, greatly improving the resolution of traps prediction. The three wells illustrate that the predicted gross thickness of conglomerate layer has the error only 3% compared with the drilling data. The velocity model is used on the pre-stacking depth migration of seismic data, greatly limiting the influence from the high velocity layers and decreasing the error of the predicted depth. So the drilling risk is greatly limited. Non-seismic methods can provide a more accurate velocity model for seismic prestack depth migration and improve the accuracy of interpreted traps.