INTRODUCTION

The limits of seismic resolution usually are cited in terms of the signal strength and frequency content of data at a given two-way travel time. It also is commonly understood that the high end of the input frequencies attenuates more quickly than the low-end input frequencies, and that resolution diminishes with depth as a result.

Some workers suggest that carefully processed and displayed data can show interpretable stratigraphic features smaller than the wavelength as defined by the dominant frequency of the data. We suggest that because three-dimensional (3-D) surveys contain a very detailed data volume covering a relatively small area and are processed in a unique way, they are ideally suited to pushing interpretations in this manner.

DISCUSSION

The lines we selected for display are traverses from a 3-D survey conducted in the offshore Texas sector of the Gulf of Mexico (Figure 1). The leases in this part of the Gulf of Mexico commonly are acquired for their deep gas potential (most production is from Miocene reservoirs in “roll-over” anticlines which formed in the hanging walls of regional growth faults, and production here is no exception).

Field development proceeded for some time before the differences in stratigraphic characteristics of the producing horizon were adequately interpreted from the well data. Only after this interpretation was fully developed did we return to the seismic data to attempt to expand our stratigraphic understanding. As is often the case, the seismic data had only been used for structural information and analysis.

Line G (Figures 2A and 2B) is a traverse extracted from the seismic data volume parallel to, and coincident with, the axis of the submarine fan we interpreted between 2.8 and 2.9 sec. The direction of sediment transport was from left to right, and the paleoseafloor surface (across which progradation took place) may be seen at the base of the interpreted interval. The upper fan facies are present to the left and offer no interpretable internal structure. This area corresponds to the area of hummocky reflectors commonly seen in the cores of some fan complexes.

The lower fan foreset facies are shown farther to the right, ideally between shotpoints 260 and 280. Those features represent sand members which—in well logs—are approximately 100 ft (30 m) thick and, as such, are approximately one-third of the wavelength of the dominant frequency in the data obtained from this horizon.

Line A (Figures 3A and 3B) was extracted from the 3-D volume normal to the direction of sediment transport. The section thins to either side of the axis of deposition. Differential compaction (which propagates the form of the fan bulge, upward through the section) also is apparent.

SUMMARY

Traverses extracted from a 3-D volume are not restricted to acquisition lines and cross lines; unique 3-D survey processing allows traverses of any orientation to be extracted. In this way, views of very subtle features can be obtained and shown to their best advantage. In our case, stratigraphic analysis of a particular horizon was the primary objective, so traverses which would best show the features of that formation were selected. By combining this seismic information with well data we demonstrated that very subtle features can be examined. In our case, the features we mapped are approximately one-third of the size one would normally expect to see in data with low frequency content, as in our 3-D survey.