2D interactive interpretation

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Introduction

The past few years have seen the interactive interpretation of 3D seismic surveys become a firmly established technique (Nelson *et al.* 1981; Gerhardstein *et al.* 1984) and several such systems are now in use in Australia (Denham *et al.* 1984). The large data volume and dense spatial coverage of a typical 3D survey were obvious first candidates for the assistance which an interactive system can give the interpreter. These systems not only relieve him of having to manipulate a very large pile of paper displays, but enable him to make a far more detailed and comprehensive interpretation than would be possible by conventional means.

The majority of currently collected seismic data is still 2D data however. While most 3D interactive interpretation systems can be used to track and time horizons on individual 2D sections, few have the ability to tie together and map the generally irregular and widely spaced grid of lines in a 2D survey. Therefore, the interpreter of 2D seismic data must still carry out most of his work by classical methods.

The Seismic Interactive Data Interpretation System (SIDIS) has been designed specifically to meet the requirements of conventional 2D interpretation. It incorporates the individual section interpretation facilities found in most 3D systems, and also handles the problems associated with mapping from an irregular grid of lines, which may be different vintages of data, and which generally do not exhibit perfect time ties. Throughout the interpretation, the geophysicist can monitor the progress of his work on video monitor maps which can be either automatically or manually contoured, or a combination of the two. SIDIS is not solely a 2D system however, but includes a full suite of 3D interactive interpretation facilities.

System description

A block diagram of SIDIS is shown in Fig. 1. The user's workstation consists of two colour monitors, a data tablet, an intelligent terminal (with its own monitor and keyboard) and a hard copy camera system. One of the colour monitors is dedicated to base map displays, and the other to seismic data interactive interpretation. The data tablet is partitioned into two areas; one of which is mapped into the image on the monitor for data addressing and digitization, and the other presents the user with a menu of functions to choose from. Instructions which require more input information than a simple menu choice can be communicated through the keyboard, while the terminal monitor presents help with the instructions. The hard copy camera provides colour photographs of transparencies of any of the monitor displays.

SIDIS requires either a VAX or Perkin Elmer 32 bit minicomputer as the host computer, with a Ramtek colour graphics processor. This system must have sufficient disc storage to hold all the data of interest, but otherwise no restrictions are placed on prospect size or individual line length.

The interpreter operates SIDIS mainly by choosing functions from a menu, thus eliminating the need to learn and remember any complex operating procedures. Each menu is displayed on the screen in a standard format, as shown in Fig. 2. Menu options are given across the top and bottom of the

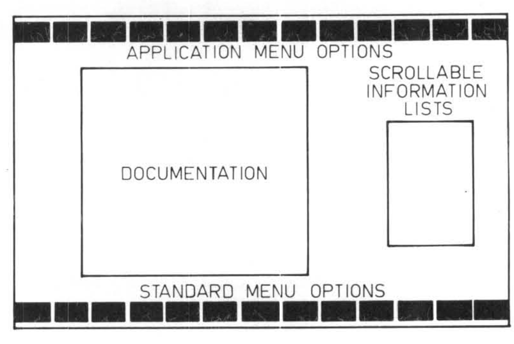

Fig 2 Standard layout of SIDIS menu.

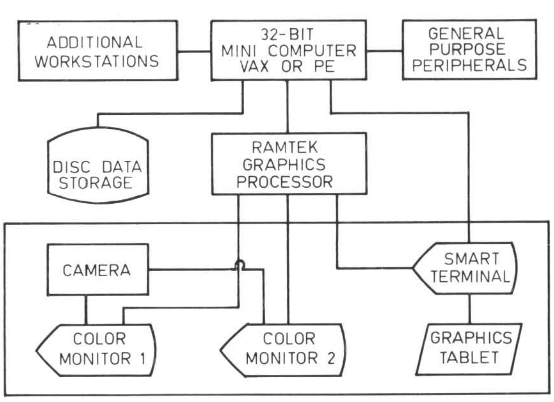

Fig 1 Block diagram of the Seismic Interactive Data Interpretation System.

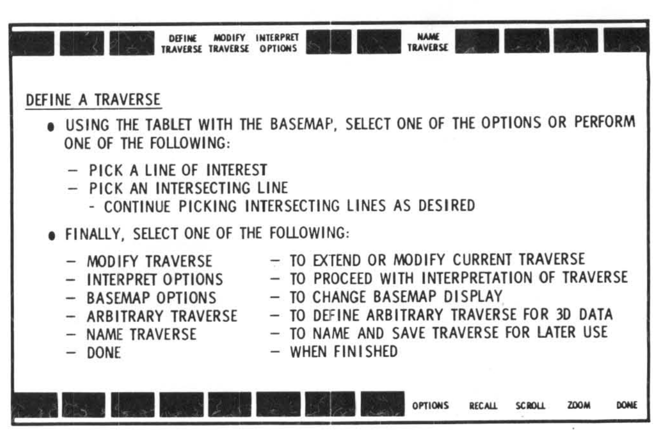

Fig 3 Example of SIDIS menu: interactive traverse definition.

screen, and information on their use is given in the centre. The interpreter chooses an option by touching the appropriate area on the data tablet. An example of a menu display is shown in Fig. 3, which is the menu for interactive traverse definition.

Interpreting a 2D prospect

Work on a prospect would be initialized by loading the data base with survey data, seismic traces, and velocity data. The interpreter would begin by displaying a prospect base map on one monitor. On this, he interactively defines the seismic traverse he wants to interpret. This traverse need not be a single line, but can consist of connecting segments of different lines. Normal practice is to define a continuous loop of line segments, and track and tie horizons around that loop, just as would be done in a conventional interpretation from paper sections. When this is complete, another loop which includes part of a previous loop would be interpreted, starting from the already picked horizons on the common portion of the loops. In this way the interpretation can be extended, finishing with line ends which do not form part of a loop.

Normally only a portion of the seismic traverse can be displayed on the data monitor at one time, and the screen rolls along the section as interpretation proceeds, until the end is reached, or a loop is completed. The section display can be zoomed to provide any display scale.

Horizons can be tracked automatically, manually, or by a combination of the two. The horizon picks are displayed on the seismic data, and horizon times and amplitudes are stored, along with correlation coefficients if the automatic tracker is used. The automatic tracking normally requires manual help across faults and other data discontinuities, and several interactive features such as the cut/fold option are available to help the user correlate across faults. Where a manual interpreter would fold a paper section to match data on opposite sides of a fault, the cut/fold option allows two panels of data from opposite sides of a fault to be displayed side by side on the screen, and one panel can be moved up and down relative to the other. In this way character can be correlated across the fault, and the fault throw can be measured. Fault tracks can be shown on the displays, and stored in the data base.

An intersection mistie data base can be built up, and various options of applying corrections are available. At any time during interactive interpretation the user may post values for a horizon on the base map, and automatically or manually contour these values. Isochron, isopach and isotime maps can be generated, making use of an input velocity field. Amplitudes can by mapped, and overlaid on time or structure maps.

Conclusion

SIDIS brings to the 2D interpreter all the benefits in speed and accuracy of an interactive interpretation and data manipulation system. Interpretation can be both quicker and more comprehensive than by conventional methods, and the precision of the time and amplitude picking will help the geophysicist respond to the increasing demands of stratigraphic interpretation.

Acknowledgments

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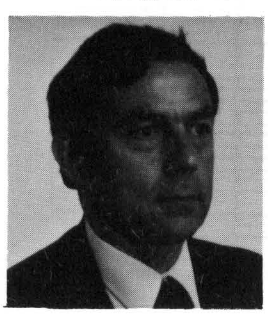

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