that this paleotopography has a cyclicity, with a crest wavelength of approximately 3 mi (5 km). Double Fourier transforms are most appropriately used in modeling where such a cyclicity exists.

The resulting double Fourier transform-generated computer model of the upper Minnelusa paleotopography shows a good correlation between the observed data points and the calculated best-fit surface. Additionally, the computer generated surface suggests areas away from present production and drilling which may warrant further exploration.

The computer generated surface data must, however, be integrated with other known geologic data and examined closely in areas where the control point spacing exceeds either the x or y direction fundamental wavelengths.

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Distributed Exploration Data Processing

Distributed Data Processing is becoming an increasingly significant part of the petroleum explorationist's computing environment. At Arco, hardware, software, and personnel of both central and remote computing sites have been linked to establish a computing resource network.

By separating those network components which can be practically and economically implemented at remote computing centers from those more suited to a central site, the explorationist is being given immediate local access to a great deal more computing resources. Because of this distribution of computing resources, considerable gains have been realized by the exploration community in terms of increased exploration efficiency, improved information transfer, and greater technical integrity.

This paper describes Arco's Computing Resource Network, some of its more elaborate capabilities, some of the currently active distributed applications, and some of the reasons for its success in an exploration environment.

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Oil and Gas Exploration Using a Microcomputer

A contouring program has been developed in Pascal for the Apple II computer using irregularly spaced data. The program plots contours and data points on the CRT and dumps the resulting map with headings on a 440 IDS printer. The contouring package is the main program of a larger system being developed to explore for oil in mature areas. The package will include a file management program for well data files, trend surface and residual surface mapping, log evaluation and mapping of log parameters, and a program to evaluate drilling deals using probabilities.

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Interactive Surface Modeling and Display for Oil Industry

As the cost of data acquisition increases, there is a corresponding increasing need to maximize the usefulness of the data at hand and to find quick cost-effective methods of data analysis.

Computers and computer graphics techniques have been used effectively to display and help analyze geophysical data. The characteristics of such data analysis (to date) are typically (1) mountains of data (i.e., numbers), and (2) little control from the user during the analysis process.

Analysis of geologic data by computer has been less successful owing to the data's qualitative nature (i.e., location of formation or geologic, province, the existence or absence of a particular rock type, etc). Here, not only is the amount of data orders of magnitude less (typically), but the data often do not have the same kind of precision as its geophysical counterpart. Further, the automatic analysis of geologic data needs a fair amount of guidance from the geologist who is familiar with the region.

Interactive computing and interactive computer graphics allow the user to see results more quickly and help to involve him in the analysis process. A methodology involving this technology is presented which will take advantage of the qualitative nature of geological data and the quantitative nature of geophysical data. This technique will allow the user to combine, correlate, modify, display, and analyze both kinds of data together.

Through such analysis of both geologic and geophysical data for both known and prospective sites, decisions can be made as to where to look for oil, or, at least, where to look for data which will, in turn, indicate where to look for oil.

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Use of Apple II in Mapping Geology of Coastal Plain of NPR Alaska

REGIONAL MAPPER is a menu-driven system in BASIC for computing and plotting (1) time, depth, and average velocity to geologic horizons; (2) interval time, thickness, and interval velocity of formations; and (3) subcropping and onlapping intervals at unconformities. The system consists of FILER, TRAVERSER, REFILER, and PLOTTER. A control point (sequential file) is a shot point with velocity analysis or a well with velocity check shot survey. Reflection time to and code number of seismic horizons are filed by digitizing table from record sections. TRAVERSER starts at a point of geologic control and, in traversing to another, parallels seismic events, records loss of horizons by onlap and truncation, and stores reflection time for geologic horizons at traversed points. REFILER reads sequential files and writes a random-access file for PLOTTER.

Permafrost and buried canyons cause velocity anomalies that complicate depth mapping. At a control point, depth (Z) is from seismically derived velocity (Z_S) and from velocity interpolated between wells (Z_W). The depth difference (D) has a non-random component (D_{nr}) and an areally random component (D_r). A plot of D for a base horizon below the velocity anomalies is contoured with smoothing to form a D_{nr} surface showing the effect of permafrost and paleocanyons. Estimated depth to base horizon is the sum of Z_W and D_{nr}. For deeper horizons, depth is that of the base horizon plus a thickness derived by the "layer cake" method.

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Trends in Graphics and Graphics Technology

Graphics technology has been evolving for at least 15 years. There have been false starts and diverse paths that have been followed. Now, however, the present state of technology and