

depth. Up to 34 depth-related markers can be defined for each project-oriented file. In addition, an x-y location is assigned for each well by reading the coordinates from a graph-paper overlay to the user's base map.

One program is used to build and maintain the file with a screen menu of available operations. A screen data form is used to enter and correct the items. Tables of contents of the wells in the file sorted in several different sequences can be listed on the monitor or the printer.

A program to selectively retrieve up to 8 data items per run through the file generates a tabular listing of the wanted items together with the well-identification information. The data items retrieved can be the stored value, the stored value less minus elevation, and the difference between 2 stored values. The retrieved data can be sorted in the same ways as the tables of contents.

The last program creates a printer-posted map of the stored values, or subsea depths, or isopach interval values. Values are normally posted to the right of an asterisk well symbol unless 2 values print in the same position, and then the second value is posted to the left. In places where 3 or more values overprint, the first 2 are posted and the well symbol is changed to a plus sign.

The programs are flexible and easy to run via screen menus. Additions and corrections to the data base are accomplished very quickly.

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Geologic Field Number and Size Assessments of Oil and Gas Plays

Assessments of undiscovered oil and gas potentials for a group of untested but geologically related prospects can be made from an estimate of the possible ranges in number and size of potential fields, assuming the play exists, coupled with an evaluation of geologic risks that it might not exist. Field size distributions can be constructed from known field reserves in geologically similar plays, from assessments of representative prospects in the play, or from simulations of distributions of the play's prospect areas, reservoir parameters and potential hydrocarbon fill. The field size distributions are truncated at both ends, at a practical minimum and at the largest size reasonable expected in the play. The possible range of number of potential fields is estimated from counted and postulated numbers of untested prospects in conjunction with a success ratio, or from look-alike field densities. The chance that the play exists is the chance that there is at least 1 field of at least the minimum size assessed. The final assessment curves, developed by Monte Carlo simulation, portray exceedance probability vs. the range of possible recoverable hydrocarbon potential.

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Production Graphics and Forecast and Evaluation Systems

The production graphics system (PGS) stores historical oil, water, and gas production data, plots these on a screen, automatically fits exponential and/or hyperbolic decline curves to the data, allows the user to alter these curves interactively, and allows transfer of the resulting decline curve information to the property record data base of the forecasting and evaluation system (FES).

The FES maintains a lease or well data base, and uses information on producing rates and prices to calculate before-tax and after-tax economics for oil and gas properties. Both PGS and FES are managed by a color-enhanced, screen-oriented facility, for entering and reviewing pertinent data.

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Geophysical Exploration in Brazilian Continental Margin: History and State of the Art

Geophysical exploration by PETROBRAS started in 1954 in the onshore basins and in 1968 in the offshore basins of the Brazilian continental margin. The major problems that these basins share are: (1) short-range lateral velocity variations; (2) poor seismic data quality in many

areas, especially on land, and (3) small traps with some degree of stratigraphic control.

In the search for the solution to these problems, the best techniques available have been tried. CDP was introduced in the early 1960s; digital recording and processing in 1968; bright-spot methodology in 1973; trace inversion in 1976; 3-D migration in 1978; and image-ray depth migration in 1981.

Facilities for computer-generated display for geophysical interpretation were made available in the early 1970s. Presently, an interactive interpretation mapping system with graphic stations is in use.

Examples of techniques applied to exploration and field development activities include time-to-depth conversion, generation of seismic synthetic logs, and porosity prediction.

Geophysics plays an important role in the exploration of the Brazilian continental margin, where recoverable volumes of oil have increased in onshore basins from 86.342 million BOE in 1954 to 2,132.81 million BOE in June 1983, and in offshore basins from 0.069 million BOE in 1968 to 1,626.73 million BOE in June, 1983. These volumes correspond to 246 bbl onshore and 520 bbl offshore per drilled meter for the same periods.

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Thermal Stabilization of Kerogen Maturation Over a Finite Reaction Duration

If a first order reaction can be assumed for kerogen maturation during burial diagenesis, then its reaction rate constant is $k = -\ln(f)/t$, where f is the fraction of kerogen transformable to hydrocarbon remaining after some functional reaction duration, t . The fraction of reactive kerogen is estimated from Tissot and Espitalie's model of vitrinite reflectance (R_o) evolution. A method for calculating the functional reaction duration is suggested by kerogen maturation experiments that show hydrocarbon generation proceeds by concurrent reactions with successively higher activation energies (E_a), which at a given temperature: (1) are already complete and not generating products; (2) are generating significant products; or (3) are slow and will not generate significant products in geologic time. The general correlation of R_o with maximum temperature suggests that at a given temperature, only a limited suite of reactions control hydrocarbon generation, and increased time at that temperature will not make the slower (high E_a) reactions geologically significant. Thus, the functional reaction duration cannot exceed the time necessary for the controlling reactions to essentially complete hydrocarbon generation (to the 99% level). Geologic field data, and kerogen maturation experiments extrapolated to geologic time and temperature ranges, suggest this occurs in 10^6 - 10^7 years.

When plotted on an Arrhenius diagram ($\ln k$ versus $1/T$), reaction rate constants calculated for 80 cases of kerogen maturation at maximum temperature show a strong linear relationship ($r = 0.77$). The pseudo E_a of the overall kerogen maturation reaction is about 9 kcal/mole, and its frequency factor is $10^{-11} \text{ sec}^{-1}$. This curve provides a method of assessing maximum paleotemperature from R_o if the kerogen has had sufficient time to stabilize.

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Distribution of Oil and Gas on Active Continental Margins

Accumulation of oil and gas in an area depends on amount and type of organic matter, adequate temperatures for generation, suitable trapping configuration, and correct timing of events. All these factors can vary considerably across active margins of both island arc and continental (Andean) type.

Forearc areas are characterized by low geothermal gradient owing to subduction, poor reservoirs derived from volcanoclastics, and relatively low organic carbon content. Although tectonic complexity may offer a wide variety of trapping configurations, overall petroleum potential is low. Gas is present in some commercial (and many noncommercial) accumulations and is in part biogenic. What little oil is present is usually paraffinic with a low sulfur content ($\approx 0.1\%$) and an API gravity in the range 30° - 35° . These facts suggest a major role for land-derived organic matter, an idea supported by the available geochemical data.

Back arc areas are characterized by higher geothermal gradients and