Continental Reserves and Deliverability

A computer system for oil and gas reserves and deliverability developed by Florida Computer Systems Co. for Florida Gas Transmission Co. and Florida Exploration Co. (subsidiaries of Continental Resources Co.) is described. The basis of the system is a data base consisting of identification, reserve and deliverability parameters, contract data, prices, and production and purchase histories. Individual data items from the data base are retrieved and manipulated to create reports.

This system was a joint project of data processing, exploration, and pipeline personnel and, as a result, it handles oil and gas information from both the buyer's and the seller's viewpoints.

Major user features of the system are: (1) on-line mode of operation with interactive programming for rapid response; (2) extensive report generation capability based on parameters specified by the user; (3) graphics capability that includes a four-color CRT terminal and printer; (4) programmed data editing and error recovery; (5) manual overrides at all levels; (6) security levels determined by user's password; (7) three methods of data access: alphanumeric name, code number, or selection from a list using a light pen.

Major technical aspects of the system are: (1) developed and running on IBM 370/138 under DOS/VSE; (2) on-line control by CICS; (3) data base maintained by DL-I Data Management System; (4) structured programming techniques; (5) parameter-driven logic; (6) documentation prepared with HIPO.

REDWINE, LOWELL, Consulting Geologist, Costa Mesa, CA

Hypothesis Combining Dilation, Natural Hydraulic Fracturing, and Dolomitization to Explain Petroleum Reservoirs in Monterey Shale, Santa Maria Area, California

Fractured reservoirs in the generally siliceous Monterey Shale of the Santa Maria area represent an anomalous lithology and type of fracturing. Some, perhaps all, are not fractured chert but parts of the Monterey embrittled by dolomitization. Reservoir fractures, unlike ubiquitous Monterey fractures, are mostly abundant, disordered, open extension fractures that commonly produce epigenetic, dolomitic breccias. These dolomite-cemented breccias commonly contain open voids, many of which are 15 cm across or larger. Breccias locally have an exploded appearance and contain some matched fragments separated by vein-like or dike-like matrix, which apparently was an injected slurry of water and oil containing fragments of dolomite and dolomitic Monterey Shale.

The highly organic Monterey also served as the source rock and probably originated as a rich diatomaceous slope sediment beneath an oxygen-minimum zone. The depositional site was much larger than the Santa Maria area and unconfined to silled basins. Local dolomitization may have been due, at least in part, to rising solutions and injected slurries.

The reservoirs are explained by a hypothesis involving repeated episodes of rock dilation followed by natural hydraulic fracturing, all produced by episodic but continued tectonic compression of the region (principal, maximum, effective stress oriented northeastward). Increasing fluid pressures enlarged underpressured dilation microfractures into macrofractures and produced breccias by hydraulic fracturing. Viscous oil expressed from indurated Monterey was pumped into voids as part of overpressured slurries whose fragments were propping agents. Dolomite precipitated from slurries, on pressure release by fracturing, partly healing the fractures. Repetition of these events fractured additional rock, so that the reservoirs grew outward and somewhat upward.

REEBURGH, WILLIAM S., Univ. Alaska, Fairbanks, AK

Methane Oxidation in Anoxic Marine Sediments

A major part of the upward methane flux in anoxic marine sediments appears to be consumed in a subsurface zone of anaerobic methane oxidation. Slope changes in the depth distributions of methane, sulfate, and total carbon dioxide concentration indicate that the downward flux of sulfate and the upward flux of methane approach zero in this zone and that the upward flux of carbon dixoide increases. A minimum in the stable carbon isotope ratio of carbon dioxide ($\delta^{13}CO_2$) coincides with this zone; the minimum appears to be due to local injection of isotopically light, methane-derived carbon dioxide. Differences in methane distributions from freshwater and marine sediments suggest that sulfate reducers are responsible for anaerobic methane oxidation in marine systems. Recent "quasi in-situ" tracer experiments using $^{14}CH_4$ confirm that methane is anaerobically oxidized. Depth distributions of methane oxidation rates in Chesapeake Bay and Skan Bay sediments show a maximum whose location and magnitude are in accord with model predictions.

REID, HUGH W., Hugh W. Reid and Assoc. Ltd., Calgary, Alberta, TOM B. DAVIS, Canadian Hunter Exploration Ltd., Calgary, Alberta, and LLOYD G. ALEXANDER, L. G. Alexander and Assoc. Ltd., Calgary, Alberta, Canada

Some Recent Developments in Drill-Stem Test Interpretation Useful to Explorationists in Tight Gas Sand Plays and in Identifying Reservoirs with Linear Geometry

Two major areas of recent development in drill-stem testing are of particular interest to geologists. The first is the use of closed chamber DST's to evaluate the very tight gas sands currently under intense exploration in areas such as Alberta's Deep Basin and various intermontane basins in the United States Rocky Mountain province. Conventional DST's of such zones frequently provide little usable data, especially in very deep wells where the time for gas to fill the drill string, reach surface, and thereby be detected, commonly exceeds allocated flow time. This problem of definitive identification of gas presence and verification of rate is overcome where closed chamber tests are utilized, since downhole gas influx is determined from instantaneous surface pressure change. Interpretation processes are explained which have enabled initial detection of gas and rate verification, and have sometimes allowed differentiation between truly impermeable and badly damaged zones. Field examples from the Deep Basin of Alberta are shown together with results after completion. Other applications are shown.

The second development is the use of DST data to identify reservoirs with linear flow geometry. Geologic situations where flow into the well bore during a test can be considered linear rather than truly radial include long narrow reservoirs with parallel boundaries such as channel sands, zones bounded by parallel sealing-fault boundaries, or naturally fractured reservoirs where an open fracture intersects the well bore. Many such situations may be identified utilizing simple graphic techniques involving plots of the pressure buildup during shut-in periods versus the square root of various time functions. These plots allow extrapolation to correct reservoir pressure (not possible with conventional Horner plots which assume radial flow, and which sometimes result in false interpretations of depletion).