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Association Round Table

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Abstracts

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Wrench Faulting in Selected Areas of Permian Basin

Landsat and NASA High Altitude Special Mission Aircraft imagery have made it possible to define at least six separate lineament trends between the Amarillo-Wichita uplift (N62°W) and the Texas lineament (N54°W) that are 200 to 330 mi (320 to 530 km) long and oriented N54°W to N62°W. These long lineaments are thought to be P shears and are left-lateral wrench faults by definition. Wrench faults, transcurrent faults, and strike-slip faults are basically synonymous; all are shear faults. Wrench faults in the earth's crust are characterized by the following: (1) very long, straight traces; (2) high angle of dip (fault with over 70° dip should be examined closely); (3) en echelon nature of faulting; (4) angles between faults that suggest shear patterns; (5) earthquake history in the region; and (6) offsets.

This left-lateral wrench fault system has been demonstrated at the Carta Valley fault zone. The Permian surface between Brown-Bassett and JM field of Terrell, Crockett, and Val Verde Counties along the Pecos River has a fracture system that is compatible with wrench faulting. In Garza and Borden Counties, the elements of left-lateral wrench faulting can be demonstrated from high altitude aircraft imagery and demonstrated on the surface and in the subsurface with seismic support.

Surface lineaments are observed on Landsat imagery throughout the Permian basin and lead to the belief that the very long N54° to 62°W lineaments are P shears. The set oriented N86° ± E are the Riedel shears and the N36°E are conjugate Riedel shears. These form high angle en echelon faults of a left-lateral wrench fault system that can be documented with faulting at the surface in Borden and Garza Counties, and with the surface alignments being documented on CDP seismic lines in the subsurface.

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Nuclear Waste—Our Radioactive Hot Potato

Nuclear industry inevitably produces nuclear waste, whose prudent, prompt and economic disposal is important to the national welfare. Technological problems of containment and isolation have apparently been solved. Underground or "geologic" disposal sites have the potential for permanent isolation, with salt, basalt, granite, shale, and tuff currently receiving principal attention as repository host rocks. Bedded salt deposits may offer the principal mechanical advantages, but in the northwestern United States the abundance of basalt at existing test sites has made it the subject of experimentation. However, psychological, political, and allegedly environmental obstructionism have stalled the process and virtually immobilized current construction.

A program is suggested with the purpose of satisfying technical requirements for public protection while allaying the exaggerated fears of anti-nuclear factions. These include seven points.

1. Minimum population density in site area-fewer than two persons per square mile.
2. Avoidance of areas of crop cultivation, or specialized industrial use.
3. Avoidance of areas of known seismicity or earthquake activity.
4. Avoidance of topographic heights or drainage lows.
5. Subsurface cover of at least 1,500 ft (457 m) for high-level wastes, and at least 150 ft (46 m) for statutorially defined low-level wastes, these depths to be exceeded wherever practical to obtain optimum repository conditions.
6. Avoidance of zones of active flow of subsurface waters, or waters having surface outlets.
7. Design and construction to serve as possible sources of artificial geothermal energy.

CRAWFORD, G. ALLAN, Union Oil Co. of California, Brea, CA, and GEORGE E. MOORE and W. SIMPSON, Union Oil Co. of California, Midland, TX

Depositional and Diagenetic Controls on Reservoir Development in a Pennsylvanian Phylloid Algal Buildup: Reinecke Field, Horseshoe Atoll, West Texas

Reinecke field is one of a series of fields in the Horseshoe atoll (Midland basin, west Texas) that produce from Pennsylvanian phylloid algal buildups. Examination of cores from the Reinecke field indicates that porosity in the field is controlled largely by two factors: (1) leaching of biotic constituents and matrix; and (2) dolomitization. These two factors have led to development of a complex reservoir.

Six major rock types have been identified from the field. These are in order of abundance: (1) medium-crystalline, ferroan dolomite, (2) echinoderm-foram wackestone, (3) echinoderm-fusulinid packstone-grainstone, (4) phylloid algal-bryozoan-foram packstone, (5) coarsely crystalline, high-porosity, ferroan dolomite, and (6) shale.

Reservoir porosity and permeability are controlled by the distribution of rock types. In the southern end of the field, two areas of differing character occur: one in which the rocks are more than 80% dolomite and a second in which the rocks consist of interbedded dolomite and fossiliferous lime wackestone to grainstone. Most of the oil from the field is produced from these two areas. A third reservoir type that rims the northern half of

the field consists largely of echinoderm-fusulinid packstone and grainstone interbedded with phylloid algal packstone. The remainder of the field has very little data available. Production from the northern half of the field is generally low.

Laterally continuous, high-porosity dolomites appear to be present throughout the field. These dolomites can transmit large volumes of fluid and are responsible for a water breakthrough problem in the field.

As a result of complex variations in depositional and diagenetic facies, the reservoir is a laterally and vertically heterogeneous rock body with complex production problems.

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Ken Regan (Delaware) Field, Reeves County, Texas

The Ken Regan field located in northern Reeves County, Texas, was discovered in July 1954. Discovery was from Delaware (Olds) sands at an approximate depth of 3,300 ft (1,005 m).

For the past 29 years, the field has experienced periods of active development followed by long periods of no activity. To date, the ultimate field limits have not been established and development continues.

The reservoir is a deep marine channel similar to, but slightly older than, the Ramsey sand of the upper Bell Canyon. Deposition of the Olds channel was from the northeast along the bottom of the basin. Subsequent eastward tilting has positioned the trap along the western boundary of the channel. Because of the irregularity of bottom-floor topography, prediction of the channel direction remains a challenge.

Oil economics have played an important part in development of this field and many like it. Drops in oil prices can completely choke off development in "bread and butter" pays such as the Delaware sand. The operators who do the best with the least expenditure will survive to continue to develop fields of this nature.

Ken Regan field will be 30 years old in July 1984. It should continue to expand in size until the ultimate channel terminus is found or until economics preclude further drilling. Use of modern concepts of deep marine sedimentation has influenced much of the drilling which has occurred in recent years.

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Langley Deep Field, Discovery and Interpretation

In May 1978, ARCO Oil and Gas Co. completed the Langley Deep Unit 1 well in Lea County, New Mexico, discovering a deep gas field with production from two horizons. The discovery well produces gas from a northwest-southeast-trending anticline that has a reverse fault at the Ellenburger formation on the northeast flank of the structure. This reverse fault, possibly persistent to the base of the Wolfcamp Formation, generated an anticlinal feature in the upthrown block at the Devonian level. The fault itself is the trap at the Ellenburger formation.

Major seismic evaluation of the eastern flank of the Delaware basin had proceeded for 10 years prior to the discovery of the Langley Deep field. The first major seismic group shoot, conducted in 1968, started on the Central Basin platform and proceeded into the Delaware basin. These seismic records had good, continuous, shallow reflectors. Deeper reflectors were present only on the Central Basin platform or in the deeper part of the Delaware basin but not on the eastern flank of the basin. By changing the field acquisition parameters and later the processing techniques, ARCO Oil and Gas Co. was able to improve the quality of the data and to identify continuous reflectors from the Delaware basin up onto the Central Basin platform, at least at the Devonian level. These improved seismic data delineated an anticlinal feature with an associated fault trap that is the Langley Deep field.

Since the discovery of the Langley Deep field in 1978, a new geologic interpretation has been proposed for the eastern rim of the Delaware basin. A major conclusion, based on seismic control, the well control from this field, and on subsurface control throughout southern Lea County, New Mexico, is that a strike-slip fault was activated during the Late Pennsylvanian and Early Permian and caused deformation resulting in the formation of the Langley Deep structure.

HILLOCK, ROLAND T., Ike Lovelady, Inc., Midland, TX

Ben South (Tannehill) Oil Field, Stonewall County, Texas

Ben South is one of 157 Tannehill oil fields on the northeastern shelf of the Permian basin. Texas Railroad Commission District 7B has 66 Tannehill oil fields while District 8A has 21.

The discovery well for the Ben South field was the Ryder Scott Management (Sauder) 1 McMeans, completed in 1973. Ben South field production has totaled 749,340 bbl of oil through March 1983 from 13 wells.

Oil production is from the lower Tannehill (lower Wolfcamp) sands underlying the Stockwether Limestone. These Tannehill sands were deposited in a fluvial environment. Channel-fill and point-bar deposits make up the pay sands. The trapping mechanism is both stratigraphic and structural.

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Lower Pennsylvanian Reservoirs of Parkway-Empire South Field Area, Eddy County, New Mexico

The Parkway-Empire area is located on the Northwest shelf in central Eddy County, approximately 15 mi (24 km) northeast of Carlsbad, New Mexico. This area produces oil and gas from the lower and middle Morrow sandstones, Atoka sandstones, and Strawn limestones. Oil is also produced from the Queen and Seven Rivers sandstones, and the Grayburg, San Andres, and Wolfcamp dolomites. All of these zones are productive from stratigraphic traps.

The lower Morrow sandstones occur at a depth of about 11,400 ft (3,474 m). They are interpreted to be a prograding fluvial-deltaic sequence of channels and point bars sourced from the northwest. They trend toward the southeast, normal to depositional strike. The lower Morrow sandstones are separated from the middle Morrow sandstones by a widespread, dark gray, organic, lagoonal shale. In the Parkway area, the middle Morrow sandstones are thought to be a transgressive series of marine beaches and submarine bars which trend toward the northeast, parallel to depositional strike. Stratigraphic traps are created in the lower and middle Morrow sandstones by variations in cementation and depositional patterns. Productive Atoka sandstones occur at a depth of approximately 10,700 ft (3,261 m). These sands are thought to be a series of prograding beaches with a northeast trend. Strawn limestones produce from a series of small, low-relief algal banks developed along depositional strike to the northeast. The Strawn limestone is about 300 ft (91 m) thick and occurs between 10,250 and 10,500 ft (3,124 and 3,200 m).