in relation to its plate tectonic significance. Based on the I. O. Norton-J. G. Sclater reconstructions for the breakup of southern Gondwana, a scheme is developed illustrating the plate tectonic evolution from Triassic to present that includes (1) opening of the south Atlantic-Indian Ocean areas, (2) the formation of a marginal basin in the southern Andes in Late Jurassic-Early Cretaceous and its subsequent destruction by arc-continent collision and attendant ophiolite obduction, and (3) interaction during the Tertiary of the convergent Pacific margin and a northward migrating RRR triple junction.

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Methods for Recovering More Oil from Known Fields

Waterflooding is the dominant fluid injection method used to recover secondary oil. It is economically attractive but leaves in the ground a large fraction (~50%) of the oil originally found. In the United States, for more than 30 years, research has been active in developing improved methods which are capable of producing a substantial part of the oil not recoverable by waterflooding (tertiary oil). The methods are usable in the secondary mode (instead of waterflooding) or in the tertiary mode (after waterflooding or natural water drive). Many methods are involved; most of them use water as a major injection constituent. The most promising methods for enhanced oil rcovery (EOR) involve either miscible displacement or thermal means to free the hard-to-recover oil. Although more than 400 field projects have been started with about 226 now (1-1-80) active in the U.S., and about 100 projects outside the U.S. (predominantly thermal type in Venezuela and Canada), the commercial use is now limited nearly entirely to secondary mode applications. Prospects in the tertiary mode have demonstrated technical operability. The economic potential, however, is uncertain, being related to changing price-cost relations.

A critical factor in the successful selection and operation of EOR applications is an understanding of the nature of the geologic makeup of subject reservoirs. Thus, the exploitation geologist is expected to contribute substantially to EOR activities.

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Rigid-Peel Technique for Preserving Structures in Coarse-Grained Sediments

Low-viscosity epoxy was used to produce 30 × 120 cm peels of structures in unconsolidated sand. These peels have high strength and good visual impact, revealing both fine detail and gross features with several millimeters of relief. Epoxy was sprayed on vertical trench surfaces and heat-treated in situ using portable racks of heat lamps. Seventy-two peels were recovered out of 80 attempts in one trench.

The method is useful for gravelly sands and for fine-grained to very coarse-grained clean sands. The limiting size for vertical faces seems to be about 0.5 m high by 2 m long.

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Lateral Trapping Mechanisms in Deep Basin Gas Trap, Western Canada

The basic model for a Deep Basin gas trap is characterized by laterally extensive, low-porosity and low-permeability subsurface strata that contain gas downdip and water updip. No permeability barrier separates the two phases in the transition zone at the updip limit of the gas accumulation. Two other features of the model are significant: (1) the original gas and water phase pressures are about equal at the updip limit, and (2) there is no downdip gas/water contact.

In many respects, the Deep Basin trap is just the reverse of a conventional gas over water-type trap. In the conventional trap, gas has migrated to the highest structural position in the reservoir owing to its buoyancy in the ambient formation water phase; there is a downdip gas/water contact where original pressures in both phases are nearly equal and no permeability barrier is necessary to separate the two phases.

The physical principles controlling the Deep Basin water over gas trap are just as simple and straightforward as those long recognized for conventional traps. Because there is no downdip water phase or gas/water contact, the Deep Basin gas accumulation is not subjected to buoyancy forces as in the contentional trap. As long as pressures remain equal between both phases at the updip contact or transition zone, there will be no unbalanced forces present. As a result, the gas accumulation will remain in a state of static equilibrium. Similarly, in the conventional trap, equal pressures at the gas/water contact maintain the gas accumulation in a state of static equilibrium.

Evidence for these basic principles of Deep Basin trapping of hydrocarbons result from the study of abundant, high quality reservoir data derived from an extensive, ongoing development drilling program pursued by Canadian Hunter in the Elmworth gas field of northwestern Alberta.

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Reflection of Topography on Pre-Cretaceous Unconformity Through Overlying Section in Central Alberta

Topographic highs and lows on the pre-Cretaceous unconformity of central Alberta are reflected as irregularities in the structure of overlying formations. In some places, the effects of large highs and lows can be seen directly on structure maps of the Cretaceous formations. For example, the Leduc reef chain, which itself is up to 1,000 ft (305 m) below the unconformity, causes anomalies in the structure of all overlying formations. The effect of the Leduc reef chain can even be seen in the present-day topographic surface through approximately 6,000 ft (1,829 m) of overlying sediment from almost every geologic environment. In many places, however, the irregularities on the unconformity are small and their effects are masked by the regional dip of the Alberta basin. They also become more diffuse on the upper formations.

Trend surface analysis on the structure of the overlying formations removes the regional trend from the data so that the more subtle highs and lows can be recognized. They can be seen, not only as differences between positive and negative residuals, but also as relative highs and lows within areas of positive and negative residuals.

Advantages of using residual maps of the structure of Cretaceous formations to locate highs and lows on the pre—Cretaceous unconformity include: (1) showing that some structural and stratigraphic traps are a direct result of irregularities on the unconformity; and (2) illustrating tht despite limited well control to the unconformity, highs and lows can be mapped using the more numerous shallow-well formation top values.