March 2, 1964

PETER T. FLAWN, Bureau of Economic Geology, Austin
"Whither the Ouachitas?"

The Ouachita system includes a long sinuous belt of sedimentary rocks of distinctive facies and of generally congruent Appalachian-type structures. However, foreland facies rocks occur within the structural belt in the two major salients and locally along the structural front. Two major tectonic zones—a frontal or exterior zone marginal to the foreland and an interior zone—have been mapped. The course of the belt is known from borehole data and geophysical evidence from southwest Alabama to the U.S.-Mexico border. Geophysical evidence suggests a southeast extension beneath southern Florida. In Mexico, scattered outcrops and boreholes indicate that the system strikes south for some hundreds of miles, but data are insufficient to map tectonic divisions. Deformation occurred later or lasted longer in the southern part of the system.

One hypothesis to explain the deep foundering of the Ouachita system below the Gulf Coastal Plain is based on the apparent lack of large volumes of stabilizing granite in this part of the crust, which in turn may be due to a relatively small volume of clastic sediments deposited in the interior part of the pre-existing geosyncline. Following this hypothesis, large volumes of clastic sediments were restricted to the Ouachita Mountains and Marathon salients and to other concealed frontal basins. In Mexico, where evidence indicates granitic terranes in the interior part of the belt, the interior part of the system has not subsided as deeply as it has to the north.

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March 9, 1964

A. I. LEVORSEN, Consultant, Tulsa
"The Petroleum Potential of the Undrilled Areas of the USA"

If we are to continue the current rates of petroleum demand and production, it will be necessary to obtain more petroleum during the next 37 years, or by 2000 A.D., than during the past 100 years. And if discovery of new deposits is to continue as the most important source of petroleum, then the question becomes: "Is there oil of that magnitude yet to be discovered within the United States?" This is a geological question.

Two approaches to the problem are considered. Both are based on the fact that as so often in the past, one or more of the chief ingredients for discovery may lie staring us in the face for years before being put into the discovery recipe.

The first may be thought of as a way of thinking. The petroleum industry has gradually developed a great many fine geological administrators who deal in reports from highly trained specialists—but these administrators move farther and farther away from the rocks, and the specialists become more specialized and more microscopic in their outlook. Needed are more experienced geologists, in between, who are still with the rocks and able to integrate the various specialized elements of structure, stratigraphy, and fluids into a recipe for discovery.

One integrated-type prospect consists of an arched, updip wedge of a potential reservoir rock, coupled with a downdip flow of the reservoir water. The flanks of every fold, large and small, from the surface to the basement, and in every sedimentary area, both productive and non-productive, offer innumerable opportunities for such petroleum discovery.

The second approach lies in the simple fact that many oil fields and oil provinces —including some of the largest—occur in close association with truncated reservoir rocks. Large volumes of potential reservoir rocks, with many unconformities, well known and staring us in the face, but as yet unexplored, are cited as potentially productive on a large scale.

The answer from this "Peek at the Deep" seems to be, "There is enough potential favorable geology to supply a normal expected demand, large though it may be." The big question that remains is, "Will there be sufficient incentive to do the exploring?" And this is in the realm of economics and politics.

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March 16, 1964

W. J. BURGESS, Sinclair, Tulsa
"Dolomitization"

As most dolomites are alteration products of limestones a brief review of the nature of limestones is given in which it is shown that the deposition of limestones is analogous to the deposition of terrigenous rocks in that primary textures are determined largely by environmental conditions at the site of deposition. Limestones, however, are usually local, or intrabasinal in origin and depend on organic activity for accumulation. The resultant lime coquinas, sands, silts and muds, as well as the indurated equivalents, are subject to alteration, either in the form of "straight" recrystallization (calcite to calcite) or in the form of dolomitization.

(Other alteration processes such as chertification are not discussed here.)

Three general modes of origin for dolomites are: unconformity dolomitization, structurally controlled dolomitization (both of these usually occurring late in the history of the rock), and stratigraphic dolomitization. Studies involving penecontemporaneous stratigraphic dolomitization may give us a key to dolomitization in general. This is illustrated particularly in the penecontemporaneous dolomitization of lime muds wherein a progression may often be observed revealing individual steps in the alteration of calcilutite to dolomite: in a given calcilutite randomly oriented dolomite crystals are seen to increase in abundance to the point at which the entire rock becomes a sucrosic dolomite.

Two types of dolomitic mottling in limestones are discussed. First there occurs a depositionally controlled type of mottling in which thinly alternating zones of dolomite and limestone present a laminated appearance. An early time for the development of this type of dolomitization is deduced from the fact that plastic deformation sometimes appears to have taken place during sedimentation and following selective dolomitization of some of the laminae; the dolomitized layers reacted plastically while the calcite layers were being deposited. In general, depositionally controlled mottling is a result of incomplete or differential dolomitization. A second type of mottling, a "patchy" variety, may be attributed to the activity of burrowing organisms. While the calcite (or aragonite) muds or sands are being deposited certain organisms such as anastomosing foraminifera or tubular algae or worms may be actively reworking the materials of deposition. The organic material in the burrows may become dolomitized and the resultant rock will be mottled in a patchy manner.

The precise mechanism causing muds to become dolomitized may not be responsible for penecontemporaneous dolomitization of bioclastics and calcarenites, etc., or for later dolomitization of lithified limestones. However, we often observe shells or indurated limestones (the latter in unconformity or structurally controlled dolomitization) which have been altered to sucrosic dolomite, so that the general manner in which alteration occurs may be analogous to the manner in which calcite muds have been dolomitized; i.e., crystals form randomly replacing a portion of a calcite shell fragment, for example, increasing in number until the crystals touch and form a framework. Later dissolution of the interstitial calcite will then produce a sucrosic dolomite.

"Compact" crystalline dolomite is a type of dolomite in which the crystals are oriented in such a fashion that they fit together closely or compactly. Usually coarser than the sucrosic type, the crystals of "compact" dolomite may have formed more slowly than the crystals of the generally finer sucrosic type so that more time was available for the crystals to grow in an oriented fashion. Secondary outgrowth in sucrosic dolomites may also produce a compact type of dolomite.

Some pertinent things we can say about dolomitization at the present time are:

1. Dolomitization often destroys original textures of limestones.
2. Dolomitization is a great equalizer as regards its effects on textures of limestones. A completely dolomitized rock usually has a very uniform texture. If it is a lime mud that has been dolomitized the general texture will have been made coarser. If it is a calcarenite or calcirudite that has been dolomitized then the newly created (dolomite) texture will be finer.
3. As far as porosity is concerned, dolomitization usually tends to increase or create porosity rather than to destroy it.

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March 23, 1964

P. C. LAURINGER

Petroleum Publishing Co., Tulsa

"Europe's Second Renaissance"

A lot of things are going on in the world, and some of the things that have been going on in the world have been quite shocking and unsettling to American oilmen.

For about 100 years the world petroleum industry was, for all intents and purposes, the American oil industry. Here in the U.S.A. we produced most of the world's oil, we consumed most of it, exported most of it, and we found, produced, and controlled much of the oil in other nations. We also invented most of the industry's equipment, and we made it, exported it, and showed others how to use it.

But not any more. How come we lost dominance of the international oil business? Dozens of independent U.S. oil firms went abroad and weakened the control that had been exercised so long by the old-line international companies; host governments in producing nations began to flex their muscles and start taking a hand in their oil industries; and little local companies in foreign countries suddenly sprang to life, and got into the act themselves.

There's something behind this explanation—something very fundamental and far-