(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 farreaching and significant. It is the European economic miracle. We are seeing what I would like to call the "Second European Renaissance." A dozen or more years ago, Europe suddenly shook off its traditional complacency and began planning bright new futures for everyone and every nation. They were determined to get our way of life and our material comforts for themselves. But they're not just going to take them from us. They're going to do it themselves and in their own way. They have adopted the American spirit of enterprise and have gone all out for competition. As a result, European business is booming.

This new Europe is giving us a terrific run for our money. The European nations are finding oil and gas in places where we knew it was all the time.

Why they are finding it is this . . . the new spirit of enterprise, resourcefulness, competition, ingenuity, and determination to have more for themselves and do more for themselves. In their oil industry they are using their own equipment and their own methods as much as is practical. They insist on running their own show.

All of this also applies to Japan.

Many are concerned about conditions in Latin America. These nations are also feeling restiveness and dissatisfaction with slow economic progress. Some of them are still operating by trial and error, but there are many elements down there that are beginning to understand the essentials of a sound and progressive oil industry, and the march of events and the need for oil will certainly bring improvement before too long.

The American oil industry must hump to keep ahead of this new economic rebirth. These people in other nations have just learned that nature didn't put all the oil in the U.S. and that the art of finding oil isn't an American monopoly. They are finding oil, developing their own geological theories, their own tools, their own producing methods.

Our challenge is to reduce the cost of finding oil and bringing it to the surface. And we've got to find a lot more oil. Two things are certain: The demand for petroleum is going to grow and grow, and our present surplus of crude is going to dry up rapidly. And, there are tremendous quantities of oil and gas still hidden in the rocks under these United States, waiting to be found. Finding this oil will require new approaches, much imaginative thinking, perhaps new geological theories, probably new exploration tools.

April 6, 1964

WARREN L. CALVERT, Ohio Geological Survey, now with Shell, Columbus

"Ohio's Petroleum Development and Geological Occurrence"

Ohio's first oil boom occurred from 1890 to 1905 when the Trenton Dolomite field of northwestern Ohio was the largest oil field in the world. Now, in 1964, Ohio is again the scene of another oil boom, this time the target is the Cambrian dolomite of central Ohio. Monthly production in Morrow County increased from 36,835 barrels in January, 1963, to 452,871 barrels in December, 1963.

Stratigraphically, Ohio is composed of Paleozoic sedimentary rocks resting upon Precambrian metamorphic rocks, with a cover of Pleistocene glacial drift over the northwestern two-thirds of the state. All Paleozoic systems are represented, which, in general, thicken toward the southeast. The regional structure of Ohio is dominated by the Cincinnati Arch, a northward slightly plunging axis in the western part of the state. A gentle eastward regional dip into the Appalachian basin is common, except (1) in northeastern Ohio where dip is to the south, (2) in northwestern Ohio where dip is northwestward around the Michigan basin, and (3) in southwestern Ohio where dip is northward around the Cincinnati dome.

Oil and gas has been produced in Ohio since 1860. The productive areas of the state are in general (1) the Shallow Sand Field of eastern Ohio, which produces from stratigraphic traps and local structures in rocks of Pennsylvanian, Mississippian, and Devonian age, (2) the "Clinton" (Albion) Field of east-central Ohio, which produces from stratigraphic porosity traps in Silurian dolomites and sandstones, (3) the Trenton Field of northwestern Ohio, which produces from dolomitized Ordovician limestones, and (4) the Central Cambrian Field, which is producing from stratigraphic traps in dolomites below the Knox (post-Beekmantown) unconformity. Some overlapping of producing zones occurs between various fields. The Trenton field is now practically plugged out and many older pools in the "Clinton" and Shallow Sand fields are abandoned.

Present interest is primarily focused upon the petroleum potential of rocks of the Sauk Sequence (Knox unconformity to basement complex). Formations of the Sauk Sequence are, in ascending order, (1) Mt. Simon (basal) Sandstone, (2) Shady Dolomtie, (3) Rome Formation, (4) Conasauga Shale, (5) Maynardville Dolomite, (6) Copper Ridge Dolomite, and (7) Chepultepec Dolomite. The lower four formations, Mt. Simon Sandstone to Conasauga Shale inclusive, contain