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CLAY MINERALS IN SELECTED ARGENTINE TRIASSIC UNITS

Three Upper Triassic (Rhaetian) formations which crop out in the Hoyada de Ischigualasto, San Juan Province, Argentina, have been analyzed partly for clay-mineral content. These continental units are conformable. From oldest to youngest, they are known as Estratos de los Rastros, Estratos de Ischigualasto, and Estratos de los Colorados. More than 80 samples representing observable changes in lithologic characteristics were taken at irregular intervals from 30 meters below to 30 meters above the two interformational boundaries. In the section studied, the boundary between the two lower formations is not well defined, either on lithologic or paleontologic characteristics, and that between the upper two formations is transitional in nature (through about 30 meters).

The Estratos de los Colorados (rebeds with abundant gypsum) have illite as their principal, and in most cases only, clay mineral component. The two underlying formations contain an assemblage of kaolinite, montmorillonite, and illite. It is probable that the clay mineralogy reflects the environment in which it developed. The Estratos de los Colorados are thought to represent a desert environment in which alkaline conditions and the presence of potassium would be propitious for the formation of illite. The two underlying units, however, are dominantly composed of lacustrine deposits, commonly carbonaceous or bearing thin coal seams, and represent an environment different from that of the Estratos de los Colorados, *i.e.*, a humid, reducing environment in which cations could be leached away and kaolinite would develop.

The clay mineralogy may be useful for locating more exactly the interformational boundary between the Estratos de los Colorados and the Estratos de Ischigualasto. However, there does not appear to be any significant difference in the clay mineralogy of the Estratos de Ischigualasto and the Estratos de los Rastros which would indicate the presence of an interformational boundary.

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ALASKAN EXPLORATION

Oil seepages were noted in Alaska before the turn of the century. Exploration began as early as 1902 with the drilling of shallow wells near these seepages in the Cold Bay area of the Alaska Peninsula. In that same year drilling in the Yakataga area by the Chilkat Oil Company resulted in the discovery of the Katella field. This was Alaska's first oil field; however, it only produced 154,000 barrels from 1902 to 1933 when the topping plant was destroyed by fire and the field abandoned.

Exploration was spasmodic until World War II. At that time the government spent 45 million dollars in exploration to develop oil in Naval Petroleum Reserve No. 4 on the Arctic North Slope. Seventy-five wells were drilled in the period 1945-1953. These wells resulted in the discovery of the Umiat oil field with reserves of approximately 70 million barrels. Several

small gas fields also were found. These discoveries, though non-commercial in themselves, indicated to the industry that oil and gas could be found in the Arctic North Slope, one of the largest sedimentary basins in Alaska.

The real turning point in oil exploration in Alaska occurred in 1957 when the Richfield Oil Corporation discovered the Swanson River field. This field resulted from a seismic survey over a topographic high. Swanson River oil field has produced more than 60 million barrels of oil from 50 wells, and should recover more than 100 million additional barrels through pressure maintenance by gas injection which is presently underway.

The discovery of the Swanson River oil field began an extensive geophysical and exploratory effort on the Kenai Peninsula which still continues. By 1959 this effort had resulted in the discovery of the large Kenai gas field by Union Oil Company and Marathon, and several smaller gas fields. From 1959 until 1962 no other significant discoveries were made. It appeared that Swanson River oil field was a "freak" and that no additional oil would be found in the Cook Inlet. The industry, however, continued the search and was adventuresome enough to explore the cold waters of the Cook Inlet and to acquire leases there from the state of Alaska. In 1962 Pan American Petroleum, drilling one of these leases in the Cook Inlet, discovered the Middle Ground Shoals oil field. This field, which has more than 1,500 feet of effective pay, indicated that oil fields could be found with sufficiently large reserves to justify the costly offshore operations in Alaska.

Industry effort since 1962 has resulted in the discovery of several large oil and gas fields, and has proved this to be one of the important oil-producing provinces of the United States. In addition to the Middle Ground Shoals field, major oil accumulations have been found recently in the McArthur River, Trading Bay, West Foreland, North Redoubt, Granite Point, and Tyonek areas. Most of these discoveries are from thick pay sections. In addition to the Lower Kenai Hemlock conglomeratic sandstone, saturation has been found in multiple pay zones of the Middle Kenai Formation which have better reservoir qualities than the Hemlock. All oil fields found in the Cook Inlet basin are undersaturated. Therefore, for maximum recovery, pressure maintenance will be required.

Reserves in excess of 1 billion barrels of oil and 4 trillion cubic feet of gas have been discovered in the Cook Inlet basin. The climatic, logistic, and tide problems make the Cook Inlet basin one of the most expensive operating areas in the world. Drilling costs are high because of the need for expensive platforms designed to withstand the forces of ice and tide plus the tremendous amount of directional work, submarine pipelines, docks, terminals, and other facilities necessary for the production of crude oil in a remote area. The industry, undaunted by the complexity and expense of the problems, continues to regard Alaska as an area with good profit potential. Here the possibility still exists of finding large reserves in the United States.

The Cook Inlet basin north of the Forelands has by now been explored relatively intensely, and the land is tightly leased. No company is interested in giving up any part of its acreage that is still unexplored. The industry as a whole, especially those companies that were not fortunate enough to acquire positions in the upper Cook Inlet, is looking expectantly and hopeful-