in initiating new approaches or techniques in commercial enterprises. The broad, general fields of geochemical and electrical prospecting are believed to afford the best opportunity of developing new stratigraphic oil exploration methods. The breadth of the geochemical field is illustrated by examples of the use of geochemical measurements in oil exploration. In the field of electrical methods, several promising, undeveloped techniques are briefly discussed. The technical material in this paper is offered only to show the unexploited possibilities inherent in geochemical and electrical methods of petroleum prospecting and to indicate the depth of our ignorance in these fields.

February 11, 1963

Norman F. Williams, Arkansas Geological and Conservation Commission, Little Rock, Arkansas

"Recent Petroleum Exploration in Eastern Arkansas"

February 18, 1963

Richard A. Geyer, Geophysical Surveys Inc., Dallas, Texas

"Use of Combined Gravity and Magnetics as Oil Finding Tools"

Abstract

The resolving power of gravity and magnetic surveys can be markedly increased under certain geologic conditions when data from both types of surveys are available. A number of theoretical as well as actual examples are discussed as they apply to the solution of both regional as well as local exploration problems. A discussion of the basic principles of these two methods and their application to interpretation techniques is also presented.

February 25, 1963

Ralph W. Disney, Sinclair Oil & Gas Co., Tulsa, Oklahoma

"Basin Development, Mountain Building, and the Accretion of Continents"

Abstract

The modus operandi for the origin of continents is a recurring, integrated geological process; first, basin development, second, mountain building, and third, granitization producing marginal, external additions to the continent. It is hypothesized that the continents (shields, cratons, mountain belts, and continental shelves) with their underpinnings of granite were not a part of the original crust but have continually formed, accretion by accretion, throughout geologic time, with much of this process occurring during the long history of the Precambrian.

The keystone of this concept is found among the results of recent high pressure, high temperature experiments being carried on by George C. Kennedy, Gordon J. F. MacDonald, and others; namely the Mohorovicic discontinuity is a phase change.

The M discontinuity is dynamic in character; its depth is controlled by pressure-temperature relationships. Through seismic investigations it is known to be deepest under mountain ranges, intermediate under the continents, and shallowest under the sea floor. Mineralogy of the rocks differs on either side of the M discontinuity, but not the chemical composition. Most important is that the gabbroid rocks above have a mean density of approximately 2.8 and the eclogitic rocks below, 3.2.

Basin development is initiated when an area adjacent to a source area begins to receive sediments. The weight of these sediments causes a slight increase in pressure in the crustal rocks at the M discontinuity converting 2.8 rocks to 3.2, and a volume increment of heavy rocks is produced. This mass sinks, lowering the sea floor along with it. Sediments continue to accumulate to thicknesses of as much as 100,000 feet.

Mountain building occurs over the site of the basin. The uplift necessary to destroy the basin is provided by an increase in temperature. Sediments are poor thermoconductors and provide an insulation so that temperatures can increase. The heat source is radioactivity in the crustal rocks. Thus, this heat increase creates a volume increment of lighter rocks causing the system to float upwards, destroying the basin and building mountains.

Granitization accompanies mountain making and occurs in the depths of the basin. This newly produced granitic mass becomes an integral part of the granitic underpinning of the continent. Since basins form adjacent to an area of sufficient elevation to produce a source of sediments, throughout geologic time they have formed at or on the edge of the expanding continental mass. Age dating of the granites of North America indicates that the accretion of continents began around a nucleus or protocontinent and then continued in ever-widening bands around this nucleus.

The Gulf of Mexico is an area of possible future accretion. All the prerequisites following the above scheme are fulfilled; high M discontinuity, sediments being deposited in the basin. When the sediments become thick enough to insulate and retain the heat, the M discontinuity will be forced down by a volume increment of lighter rocks, the entire area will be uplifted, granitization will produce a mass adjacent to the present granite, and this mass will be plastered against the continent to become a newly accreted portion.

March 4, 1963

Charles E. Weaver, Continental Oil Company, Ponca City, Oklahoma
"Geological Significance of Clay Minerals in Sedimentary Rocks"

March 11, 1963

Jack L. Walper, Tulsa University, Tulsa, Oklahoma
"Petroleum Exploration in the Canadian Arctic"

Abstract

Petroleum exploration in the Canadian Arctic has only begun. Although known for some time as one of the last unexplored major sedimentary regions of the world, to date little more than reconnaissance studies have been made of its economic potential. An area the size of Texas and the entire Mid-continent region of the United States combined and geologically as diverse, this northern portion of the continent contains some of the world's greatest unexplored sedimentary basins. Upwards to 45,000 feet of sedimentary rock are present in some of these basins and numerous oil-sands and seeps indicate the presence of hydrocarbons. None of the several wells that have been drilled are strategically located to yield maximum stratigraphic data therefore more information is still obtained from measured stratigraphic sections in the numerous mountain ranges situated throughout the region.