fewer major flexures developed. The depo-axis of the Atoka probably was tectonically controlled (a facies scrap) and the depo-axis of the Plio-Miocene (if properly located) was determined by sedimentary processes.

Although the structural-sedimentation histories are, geologically, the most significant, the Plio-Miocene and the Atoka have a number of other features in common. Each is very predominantly clastic, represents a new area of maximum sediment accumulation in the depositional basin, and displaced a carbonate-shale facies. Prograding deltaic facies dominate the depositional environments but cyclic deposition is a prominant aspect of the sedimentation. Both the Atoka and the Plio-Miocene thicken at comparatively rapid rates and attain greater thicknesses than the associated older and younger sediments.

Kuendig (1959) reasoned that geosynclines should be classified by structural configuration, not sedimentary content. The similarities of the Plio-Miocene and the Atoka Indicate that sedimentary patterns reflect source areas, transport and depositional processes, and topography; not the structure of the catchmeat basin.

December 4, 1961

Richard G. Bader, Asst. Director, Earth Sciences Division, Natl. Science Foundation

"The Association of Organic Materials and Minerals in the Sea"

Abstract

The building blocks for scientific endeavors such as Geology, Geochemistry and Oceanography are the observations resulting from field work. These field observations or experiences have given us the basic descriptions upon which to work. The descriptions themselves, however, are not the end product. We wish to explain how such an arrangement is possible; we strive to determine the mechanism or mechanisms which may be operative thereby giving us the product which has been described. One possible method available to us in our search for representative factual information on these mechanisms is that of laboratory experimentation.

The specific problem to be discussed concerns the inclusion of organic material into marine sediments. Both sedimentary minerals and organic material are found in the sea, the water column representing a temporary place of residence. The sediment particles pass through the water column to become a part of the marine bottom deposits. The organic material has three routes to follow; it can be incorporated into the living organisms of the sea, be decomposed into its ultimate products, or find its way into the bottom deposits. The point of interest here is the latter, and there are two basic ways for sea borne organic material to become a part of the deposits, by settling out as discrete particles or by being removed from the dissolved state in an association with organic particles. The settling of discrete particles is readily observed by fragmental inclusions in deposits. The association of dissolved organic compounds with minerals in the sea has been concluded but hardly demonstrated. Likewise, the mechanism for such an association has been inferred but remains essentially unsubstanciated.

Because of the complexity of the mineral-organic association in an aqueous system and the difficulty or impossibility of investigating such an association in the sea itself, controlled laboratory experiments represent one possible means of approach. The investigation to be discussed revolves about the ecological and geochemical significance of organic material in sedimentary deposits and is based on the use of radioactive tracer methods devised for elucidating the mechanisms of mineral-organic associations.

The minerals used in these studies were montomorillonite, illite, kaolinite and quartz. The specific organic compounds, all reported to exist in sea water or natural deposits, include carbohydrates, monoamino-di carboxylic acids and monoamino-monocarboxylic acids. The effects of organic and mineral concentration and species, chlornity, temperature, settling rate and pH were all considered.

The results of this preliminary experimental program demonstrate that minerals settling through a water column remove dissolved organic compounds from solution and incorporate them into the resulting sediment deposits. This association is not a random system, but follows a definite differential selection process primarily dependent upon mineral types, i. e. "active surface area," and molecular weight, structure and functional groups of the organic compound. Chlorinity, temperature, settling rates, and pH have secondary effects upon the system. The results cannot be explained on the basis of a classical adsorption phenomona, but rather indicate the development of a partially non reversable complex clay organic gel.

December 18, 1961

Walter K. Link, Consultant, La Porte, Indiana

"The Geology of the Amazon Basin of Brazil and Case History of Exploration, 1954-60"

Abstract

Systematic exploration for oil in the Amazon basin of Brazil was begun in a large way with the formation of Petrobras in 1953 and which got underway in 1954. This has been actively pursued ever since. Prior to this time little was known of the Amazon geology except for the paleontological studies of the Paleozoic areas in the north and south rims of the basin. These were started in the late half of the 1800's. A few shallow wells had been drilled on the Tapajos River on the south side of the basin and on the Monte Alegro Dome on the north side.

Under the direction of the Conselho Nacional de Petroleo, a government entity, some exploration was done in the late forties and early fifties prior to the formation of Petrobras. Three wells were drilled in the Amazon Delta and two were drilling in the Amazon proper when Petrobras took over in 1954.

The Amazon basin is an east-west trending Paleozoic basin with Cambrian, Silurian, Devonian and Pennsylvanian rocks. No Ordovician, Mississippian, Permian, Triassic or Jurassic has so far been recognized. Continental Cretaceous and Tertiary cover 95 per cent of the basin area and all except a narrow outcrop belt of Paleozoic on the north and south rims of the basin.

This huge basin appears to be structurally featureless. North south trending positive areas, which are known as the Gurupa, Parintis Puris and Iquitos Arches interrupt the east-west depression at four to five hundred mile intervals. Except for the Monte Alegre Dome, which was caused by igneous intrusion, no local structure has been found by any of the exploration methods used including drilling. The geological history is one of a gentle breathing during Paleozoic time involving sediments that were deposited between two great crystalline shields known as the Guiana and Brazillian shields.

Over $150,000,000.00 have been spent on Amazon exploration since 1954 on surface geology, gravimeter work, airborne magnetometer surveys, seismograph surveys and drilling. Over 100 holes ranging in depth from 1500 to 4000 meters were discovered. All geophysical surveys are made impotent by the injection of igneous rocks and lava flows into the Paleozoic section. These flows are thought to be early Mesozoic in age.