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Lunar and Terrestrial Exploration

This has been a remarkable year for geology and associated disciplines. Two great developments have enriched these fields with new knowledge, new puzzles, and new objects for study. The most widely publicized of these developments is the exploration of the moon. Examinations of lunar samples are progressing well, scientists are very excited about what they have been finding, and some results will be released in January. Investigators have only begun to study materials from the Apollo 11 landing, and specimens from Apollo 12 will soon be available.

The second development is the success of an extensive program of drilling of the deep-sea bottom. Holes have been drilled at 66 carefully selected sites in the Gulf of Mexico, the Caribbean Sea, and the Atlantic and Pacific oceans. At about 20 of the sites, cores all the way down to the igneous basement have been obtained. To date, examinations of the cores have been conducted on shipboard, but major conclusions have already been announced.

In terms of the total history of the earth, the present ocean basins are relatively recent features. Although the most ancient rocks on the continents are about 3400 million years old, the oldest sediments obtained from the deep-sea bottoms are only 140 million years old.

Results from the drilling strongly support hypotheses of sea-floor spreading and continental drift. About 200 million years ago, Europe, North America, South America, and Africa were joined, but at that time the separation of Europe and North America began. Examination of cores from the Atlantic Ocean reveals that new crust is forming at the Mid-Atlantic Ridge and is spreading on either side of it. The rate of movement ranges from 1 to 4 centimeters per year. The results confirm earlier views based on magnetic observations. However, the deep-sea drilling has changed speculation into something that must be regarded as established. Geophysicists point out that the drilling has a related benefit. It is fairly easy to survey large areas of the ocean with airborne magnetometers or with ship-carried seismic equipment. Results from drilling now permit confident interpretation of these geophysical observations.

In addition to the lateral movements of the continents there have been vertical motions, both up and down. For example, an area east of Brazil that was once at sea level is now 2000 meters beneath the surface.

Detailed study of the cores will begin shortly. Samples will be broadly available. They will provide an improved history of life, of climatic change, and of geochemical events in the oceans and the sediments.

The National Science Foundation has announced that it will support additional deep-sea drilling, which will facilitate exploration in the Mediterranean Sea, the Indian Ocean, and other as yet untapped areas. In addition, the drilling company Global Marine has plans to develop techniques whereby dulled bits can be changed and drill holes can be reentered. It will then be possible to obtain cores of substantial length in the basement rocks.

One cannot foresee the new knowledge, the new questions, and the new opportunities that will arise from the two great recent developments. It is clear, however, that before another decade is over our understanding of the earth and the solar system will be substantially increased.

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