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New Data Show North America is Rotating, Sinking, Rising, and Tilting

Man has known for years that the earth is not stable. Violent natural forces, such as earthquakes, storms, and volcanoes, are continually altering its face. Now scientists say that the continents are slowly sinking, rising, tilting, and rotating. Continuing investigations by Charles Whitten, Chief Geodesist of the National Ocean Survey of NOAA, and other geodesists have resulted in some interesting findings and a better insight into the problems that arise as the land undergoes subtle but marked changes.

Recent studies by geologists and geophysicists indicate that the North American continent is rotating counterclockwise at the rate of five degrees every 10 million years. Any point on the west coast—Seattle, Washington, for example—will in the next 10 million years, rotate approximately 100 miles southward. While the west coast is rotating southward, the east coast is moving in a northerly direction. Europe and Asia are apparently moving clockwise, in an opposite direction to that of North America, and somewhat more slowly—about four degrees every 10 million years.

North America is also sinking, rising, and tilting as it rotates. This is evidenced by the slowly but inexorably rising waters that imperil homes and industries along the Atlantic and gulf coasts and some of the Great Lakes, and the spray that increasingly whips across the Chicago lakefront as the waters of Lake Michigan continue to rise.

New studies during the past three or four years by geodetic field parties of the National Ocean Survey indicate that the Atlantic coast from Portland, Maine, to New York has either sunk as much as 10 inches in this century or the ocean has risen by the same amount; it is probably a combination of both. Neither can be

precisely determined. The computations are based on a comparison with surveys of elevations made forty to eighty years ago.

The surveys show that the New England coast is subsiding at a rate of about a ¼-inch per year, or about 2½ feet per century. Northern Illinois appears to have risen approximately 18 inches during the past seven decades at a rate of more than 2 feet a century. Northern Michigan and northern Wisconsin are being uplifted at a rate of approximately ½-inch per year, or 5 feet every 100 years. The continent from Wisconsin-Michigan to the Atlantic coast is therefore tilting almost 7½ feet per century. To the south, along the gulf coast of Louisiana, the land is subsiding approximately 1½ feet per century.

‘These rates of movement may seem rather small, but the effects are subtle,’ said Whitten. ‘They affect the maintenance of proper water levels, especially in the Great Lakes system where the drainage of the entire north-central area of the country is being affected. Lake Michigan, with the water surface responding as a gigantic leveling device, provides an illusion that Chicago and the metropolitan areas nearby are subsiding. This is not the case, but the result is the same, because the water level of the south end of Lake Michigan is rising.

‘Furthermore, there are greater threats for future flooding along the gulf coast, the New England coast and parts of the Great Lakes. The rates of subsidence are substantial. When these effects are combined with the effect of a slowly rising level of the oceans resulting from the melting of ice caps and glaciers, there will be real and serious hazards in future years, probably as early as the next fifty to one hundred years, confronting these coastal regions.’

Whitten explained that NOAA is engaged in a program for releveling a basic surveying framework within the forty-eight conterminous states. Several loops of this resurvey, which vary from approximately 200 to 300 miles on a side, have been completed. It is by comparing the new elevations with those measured forty to eighty years ago by geodetic survey teams that a determination is now being

made of how the earth is changing. ‘From these, the rates of vertical movement of the land can be computed,’ explained Whitten, ‘and one can view the broad pattern of crustal movement which is taking place.’

Whitten said that while subsidence and uplifting of the land are essentially very slow processes, this is not necessarily true in all instances. He pointed out that in California the subsidence of the earth in some regions is so acute that the direction of the water flow in irrigation ditches has been reversed. This is especially noticeable, he said, in the San Joaquin valley, where painstaking measurements by geodetic field parties reveal that some land has subsided almost 30 feet in the last 35 years.

Whitten said that one probable cause for the earth’s subsidence is the tremendous rise in industrial activity with the ever-widening demands for increased supplies of water. This is especially true along the east coast. As more water is drawn from beneath the surface, the earth continues to subside into the void thus created. In some areas, he added, the withdrawal from the earth of deposits such as petroleum and coal has the same result. ©

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