tion. Still another specimen of the same tumor, on being measured twenty-four hours after inoculation was found to have increased in size fourteen fold, and after forty-eight hours twenty-two fold, the changes being plainly visible to the naked eye.

It is impossible at the present time to estimate the value of these observations. From the view point of the biologist the production of active manifest life—for where there is cell proliferation and growth there is manifested an active life process—is of infinite academic interest. From the philosophical standpoint a new factor is added to the great problem of life and death. To the mind of the experimental worker in medical science an entirely new field of possibility is thrown open for the study of cancer. Now that it is possible actually to see tumor cells grow and to study directly the various factors which stimulate or retard that growth, it is not extravagant to say that a gigantic stride has been taken toward the discovery of the cause of cancer and the ultimate goal of its prevention and cure.

T. WOOD CLARKE

UTICA, N. Y.

A NEW LABYRINTHODONT FROM KANSAS

THE National Museum has recently sent the writer, through the courtesy of Mr. C. W. Gilmore, two specimens which represent a new form of the labyrinthodont amphibia. The specimens comprise a nearly perfect left mandible and a portion of the left side of the face of possibly the same individual. The material comes from "The Coal Measures of Washington County, Kansas." It was among the collections of Dr. Gustav Hambach, now the property of the National Museum.

The stereospondylous amphibia have been suggested in the Carboniferous of North America by several discoveries, notably the two vertebræ described by Marsh as *Eosaurus canadensis* and the tooth from the Coal Measures of Kansas referred by Williston to *Mastodonsaurus*. This is, however, the first actual discovery of any considerable labyrinthodont material from the Carboniferous (? Lower Permian) and as such it is of great interest.

The anatomical characters are so similar to those of *Anaschisma* described by Branson from the Triassic of Wyoming that the species is ascribed without hesitation to the Stereospondylia. The differences between the forms are of generic significance, although the distinctions are not so great as we should expect in forms which are so widely separated stratigraphically. No character in mandible, skull or ribs is primitive. The form will be described and figured soon as a new member of the Labyrinthodontidæ.

ROY L. MOODIE

THE UNIVERSITY OF KANSAS,
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SPECIAL ARTICLES

THE SUPPOSED RECENT SUBSIDENCE OF THE MASSACHUSETTS AND NEW JERSEY COASTS

MUCH evidence has been adduced in support of the theory that various portions of the Atlantic coast have been recently undergoing a gradual subsidence, and this movement is believed by many to be still in progress. The rate of subsidence has been calculated as one foot per century for the Massachusetts coast, and from one to two feet per century for the New Jersey coast. Among the lines of evidence which appear to support the theory are the following: Indian shell heaps are found below high-tide level; stumps of trees are found in place in salt marshes, showing that the trees were killed by the invasion of salt water; peat formed by salt-water vegetation is found overlying fresh-water peat; familiar landmarks are covered by high tides to greater depths than formerly; land owners along salt marshes find that the marsh areas have recently encroached upon the upland areas; the tides have increased in height to such an extent that certain tidal mills can no longer be operated as effectively as formerly; dykes erected to keep the tides out of certain salt-marsh meadows are themselves submerged by the rise of the tides; accurate measurements show that a bench-mark established at Boston three quarters of a century ago is now three quarters of a foot nearer the mean level of the sea above which it was placed than it was when first put in position.

More or less opposed to the theory of subsidence are certain suggestions which have been advanced to account for the foregoing lines of evidence without invoking a widespread subsidence of the land. Among these suggestions we may note the following: beach sands and sand dunes encroaching on a marsh will so weight it down as to cause local subsidence; draining marshes may cause a settling of from one to several feet; fresh marshes and forests may occupy depressions separated from the ocean by a barrier beach, under such conditions that a breach in the barrier would admit the sea to kill the trees and cover the fresh-water peat with salt vegetation; changes in direction or velocity of ocean currents may cause local changes in mean sea level; variations in tidal components having from six-hour to nineteen-year periods may cause long period oscillations of sea level; abnormal variations of atmospheric pressure, recurring in three- and eight-year periods, cause periodic variations in the level of the sea.

The writer would call attention to a factor which produces fictitious appearances of coastal subsidence, and which he believes to have a higher degree of importance than any of those mentioned above. As a tidal wave approaches an irregular coast it is materially modified in shape and in height. If a surface could be constructed to pass through every point reached by the crest of the tidal wave, it would be found to have marked undulations of considerable complexity. The surface would rise well above mean sea level in bays which are widely open at their mouths and converge toward their heads; but would descend abruptly toward mean sea level where a narrow inlet connected the ocean with a broad, land-locked bay or lagoon. Within such an enclosed bay this "high-tide surface" might be a number of feet lower than that portion of the surface immediately outside of the enclosing arms of land.

The irregular high-tide surface is very unstable, and will undergo modifications as waves and currents erode islands, build bars, silt up or scour out channels, break through barrier beaches, or otherwise modify the shoreline and adjacent shallow water areas. Where waves break through a bar enclosing a bay which was formerly connected with the ocean by a narrow inlet, the high-tide surface within the bay may instantly be raised several feet, since the broader opening permits the rising waters to enter freely and so give tides within the bay as high as those in the adjacent ocean. A more gradual enlargement of the inlet would cause a gradual elevation of that portion of the high-tide surface within the bay; whereas a growing bar might cause a decrease in the height of the same surface. If the size of the inlet remains constant, then silting up of the bay, the encroachment of tidal marshes, or the reclaiming of part of the bay surface by artificial filling or by the construction of dykes, will cause a raising of the high tide surface within the remaining areas of the bay; for the water entering through the narrow inlet, having less area to spread over, will accumulate to a greater depth than formerly.

Now it is the irregular and changeable high-tide surface, rather than the mean sea level, which is most important in discussions of coastal subsidence. Tidal marshes build up to the level of the high-tide surface; and owing to the inequalities of this surface, marsh level may vary a number of feet in closely adjacent areas. A breach in an enclosing bar, a widening of a tidal inlet, artificial encroachments on the bay area, or other shoreline changes, may cause the high-tide surface to rise locally. Salt water will then invade the adjacent forested slopes and kill the trees; salt marsh deposits will build up to the new high level, encroaching on the upland areas, surrounding and later burying the stumps of the killed trees, and covering the fresh-water peat formed along the margins of the fresh marsh and along the rivers emptying into the bay, with salt-water peat; ancient landmarks will be submerged, Indian shell heaps will now be found below the high-tide level, old dykes on the marsh will first be submerged by the high tides and later buried in salt marsh deposits; and so the various evidences advanced in favor of coastal subsidence will be produced without any vertical movement of the land.

A valuable demonstration of the importance of this principle has been furnished by nature on a fairly large scale near Scituate, Mass. The "Portland Storm" of 1898 broke through the bar which almost separated the North River marshes and bay from the ocean, thereby allowing a freer access of water to the bay and raising the high tide surface from one to several feet above its former position. Within two years the shores of the marsh were bordered by a zone of dead trees, the width of the zone varying from a few feet to a number of hundred feet and being widest where fresh-water vegetation had formerly encroached some distance on the marsh surface. To-day the marsh is gradually building up toward the new high-tide level, and one may see an old dyke completely covered with salt-marsh vegetation, and dead trunks of pines, cedars, birches and oaks standing surrounded by the salt grasses. A bathing pool in the North River, formerly of fresh water, is now saline; and the fresh marshes some distance up the river are now being transformed to salt marshes.

Boston Harbor and the smaller bays and marshes which ramify inland from it have been much altered during the last three-quarters of a century. In particular, large areas of bay and marsh have been reclaimed from the sea, thereby decreasing the extent to which tidal waters must spread out after passing through such narrows as that between Boston and East Boston. It is inevitable that such changes should affect the level of the high-tide surface, and perhaps that of half-tide as well. One must doubt, therefore, the validity of evidence in favor of subsidence based on the fact that an accurately established bench mark no longer bears its original relation to tidal heights.

Both on the Massachusetts and on the New Jersey coast conditions favor appreciable changes of high-tide level due to changes in the shorelines. In the light of the facts stated above, the evidence of recent subsidence along these coasts thus far presented must be considered inconclusive. That there has been subsidence in the past seems reasonably certain; but the writer knows of no satisfactory evidence of recent subsidence in these two areas.

D. W. JOHNSON

THE GLACIAL ORIGIN OF THE ROXBURY CONGLOMERATE

IN England, as long ago as 1855, Sir Andrew C. Ramsay found evidence of glacial action in the Permian rocks of the Midlands. Since that time evidence of the Permian Ice Age has been found in India, Australia, South Africa and South America.

Dr. La Forge, while engaged in the geological survey of the Boston region, for the United States government, came upon a curious outcrop of the conglomerate known as the Roxbury, at a locality in the town of Hyde Park, south of Boston. Last December we visited this section. Here the rock contains pebbles and boulders up to several feet in diameter, largely angular or subangular, scattered rather sparsely through a "pasty" matrix which forms the greater part of the bulk of the rock. There are no traces of bedding or of water action during deposition, and Mr. Sayles was so impressed by the resemblance of the rock to a glacial deposit that he at once suggested the probability of its being *tillite*. Other localities where the rock displays the same characters were visited, but soon a heavy snow-fall prevented any systematic work until spring, when Mr. Sayles made a careful search at several localities for definite evidence of glacial origin, and secured numerous chipped or faceted pebbles, some showing apparent glacial striæ.

More recently, in company with Dr. Ellsworth Huntington, we visited the extensive exposures at the same horizon on the peninsula of Squantum, in Quincy, southeast of Boston, where the rock is much like that at Hyde Park, but the proportion of pebbles to matrix is greater, the matrix is often more