

SEA SHELLS ON THE COLORADO DESERT.

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the past from the mind of Professor Du Bois. There is in all history no more touching page than that which records the simple circumstances attending this last operation.

In a dimly lighted room of the old city hall of San Francisco, on the evening of March 31st, 1946, were assembled the heads of the Labor Unions, the cabinet officers of the United States, the principal officials of the city, and a delegation of the most noted scientists of the country. It was a solemn occasion. Issues of life and death hung in the balance, and a writer who was present describes the scene as impressive beyond the power of words to portray.

The scientist was led into the midst of the assembly — a pale, slim figure, wan and trembling with emotion, but with the fire of delirium in his burning eyes.

The mesmerist confronted him and fixing upon him his searching gaze, passed his hands over the high, white brow. For a moment the influence was resisted and glance was met by glance, and then slowly — as droops a flower under the rain — the noble head bowed and tears streamed from the veiled eyes.

"Do you comprehend the secret of the power exerted through the mind motors?" the mesmerist asked.

"I do," came the reply in hoarse, muffled tones.

"Then I command you, now and forever to efface all memory thereof from your mind."

And the answer came, so low that it was but a sob, "It is forgotten."

With these words, passed out into the darkness, whence it came, the mightiest knowledge that the world has ever known.

Alexander M. Reynolds.

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GEOLOGY UNDER A CACTUS



WADING at mid-day along the western edge of the Colorado desert, where the drear monotony begins to heave into the foothills of the San Bernardino mountains, I became greatly fatigued and despite the fact that my gallon tin flask was yet half filled with water, I was almost famished because of the excessive evaporation from the skin, a phenomenon peculiar to that region. I dismounted and sought shelter under an old cactus which spread its limbs broadly like an ancient apple tree, while with the tufts of inflorescence which hung pendulous

from them, it cast upon the ground a thin shade mottled with patches of white sunlight.

As I threw myself upon the ground my boot struck what I thought to be a stone; but its shape was so peculiar that I took from my saddle pack a pick and in a moment had the thing overturned. Imagine my surprise to find it an enormous shell. It was the curved or dorsal valve of an oyster, measuring fully a foot long and nearly eight inches across, laminated and coarsely foliated in structure, its inner surface smooth with white nacre, all showing plainly its relation to salt water.

A strange thing to find in the middle of the great Californian desert! Whence did it come? Out of the Gulf of California? Pearl oysters grew there in abundance, but this was not such a shell. It greatly resembled those delicious shell-fish which twenty years ago grew at the mouth of Lynnhaven creek in the James River channel of the Chesapeake bay, and famous the world over as Lynnhaven oysters. In the brackish waters there, washed one hour by the tide of the salt Atlantic, but a few miles distant, and at another by the limpid stream which moved down from the pure springs of the woodlands, these oysters expanded to a size attained nowhere else by the edible variety. Could some Maryland or Virginian epicure, bound across this desert, have brought thither some Lynnhaven "selects" and trailed his course with the shells of these toothsome delicacies?

As I contemplated the shell my mind wandered through pages of old geology, and I recalled the great oyster *Ostrea titan*, which had existed in the Miocene period, and here unquestionably it was. If so, I held in my hand a sea shell which had grown thousands, perhaps millions, of years ago, and if it had been deposited there where I found it, it showed that the sea had once spread over the land upon which I stood. I looked over the broad areas glistening under the white hot sun, the baked air dancing above them, and tried to imagine the old Pacific resting peacefully there, prismatic under that same sun, its edge fringed with white surf washing the brown chocolate of the naked mountains.

Nor was I extravagant in my imagination. Astounding as the fact is that at the present day this desert lies for the most part over a thousand feet above the level of the sea, yet the evidence of the ocean's having once reposed upon it does not rest upon my one old shell. West of

where I stood and at an elevation greater than that I have named, there is a vast bed of these very shells. They lie there just as today beds of smaller oysters confine the salt sluices on the Virginia marshes to their banks.

Nor does it argue that at the bed of titan shells the old ocean ended. It is possible that when those great oysters were alive and fat some Cenozoic physalia spread his jelly sails on the ocean's breast many fathoms above them; for not earlier than 1882 there was found 140 feet under the surface of the North sea, a bed of living oysters two hundred miles long and seventy miles wide. From this proof that the mollusk will exist at such depths and under such water weights, we may look further to the north and west, to hunt the limits of the Pacific in those old days when the very hills were young.

The search is not without reward; for it has not been a great while since geological science found Miocene fossils abundant and varied in the region of the Kern River cañon, showing beyond doubt that once the blue brine, which now bows so serenely from the pleasant shores of Santa Barbara, rolled over all that hilly district which for a hundred and fifty miles now flanks the sea, rolled up against and over the tops of the Coast range and the Sierra Madre, rolled down into the great basin beyond, where now are the lakes of Kern and Tulare, where now lie the baked plains of the Mojave and Colorado deserts, rolled over these and up, away up, against the bleak bare granites of the Sierra Nevada.

It was along this rim of coast line that the bellowing old monster washed up from its sands and clay such shells as the *Factan cerrocensis*, six inches long by five wide, the *Venus psarianusis*, a small clam, and the *Venusta* of the family of cancellariidæ, a turreted shell with distant



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longitudinal ribs, many of which mollusks are living now, their shells rich in olives, creams, and chestnut browns.

It will be observed that these forms of shells are all familiar to us as existing to-

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day. It was in the Miocene period that the old ended and the new began. We find fossils belonging to the Cretaceous and earlier eras, but they are all strange to us.

"In this period," said a great geologist, "commenced the relations between the various orders which prevail now. The present basis of adjustment was then established."

But how comes it that these sea shells strewn over the Colorado desert lie at great elevations? Why is it that the spot where I found this remnant of an oyster was a thousand feet higher than the Pacific? Has the ocean dried up and grown less? Has it receded from the land? The rock sharps tell us that it is so, and even figure out the billion or so years when the ocean floors will all be dry. But however that may be, this particular part of the earth is now dry because it has risen. It has risen "like a sea-Cybele," and the waters have drawn back. It is still rising, while other quarters of the globe have been sinking, until whole continents have been submerged and only the tops of their mountains hold themselves above the waters as groups of islands, as is the case with the Oceanic archipelago.

But we need not rely upon speculation, even though it be scientific, to determine that the Colorado desert and the vast region which it joins have risen from what now seems great depths, and are still rising. We have, indeed, immediately at hand a most remarkable attestation, not only of the fact that the earth's surface has risen and is rising, but, most wonderful of all, of the very rates or degrees of speed with which it has risen in the various geological ages since it has been above the water. This marvelous inscription is afforded us by the cañons of the Colorado. For myriads of years that river has been flowing from high lands to the sea. From the time its first slow mlner's inch gathered current to push its way toward the south, it has been trying, every foot of its distance, to find a level. In seeking this it has not

depended upon extraneous forces, but as best it could, has itself contributed toward that adjustment. It has been cutting down the high places and filling in the low places. There was a day when the Colorado river flowed in an easy bed over the wide plateau from which the tourist now looks down two thousand feet beneath him to find its stream. If that plateau had never risen, the river would still be on its surface; but as it rose it formed grades down which the river ran faster, and as it ran it cut. When the earth rose very fast, the river, running swifter, contracted its volume as it increased its speed and its friction cut narrow deep channels. When the rate of terrestrial elevation slackened, the river ran correspondingly slower, until at one period there was no rise at all. Then the river spread and stood in pools, as is manifest by that wide area in the old channel about half way down the ravine, where the sides of the cliffs are gouged out over a broad esplanade. But as soon as the earth began to rise again, the river drew to the center and began cutting, and so it will continue to cut if the earth's crust does not cease to rise, until it is far down into the Azoic rocks.

But the shells of the Colorado desert are not confined to the sea variety. Some years ago the Southern Pacific railroad sank a well in the desert at the station of Walters, prospecting for fresh water. It penetrated a dry clay to the depth of over forty feet, then it passed through a bed the of fossil fresh water shells, just above water, which was struck at forty-seven feet and which filled the well to within twelve feet of its surface. These shells lay at a depth of 196 feet below the present level of the ocean, indisputable evidence of the past presence of a lake upon the spot. There were over three hundred of them in a lump of earth as big as a fist, and the species were of the *Physa*

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humerosa, the *Tyronia* and the *Anodonta*. These first two are merely snails, having a sinistrally coiled shell with a serriform expanded crown; the last is a mussel, with a sublate, smooth, elliptical, somewhat inflated shell. The *Anodonta* is now found alive in numbers in the Colorado river. The *Tyronia* is peculiar to California and the Colorado desert is described as being its "metropolis," where it probably originated and whence it has spread to the adjacent districts.

But how do we account for the fact that these lake shells are imbedded nearly fifty feet below the surface, while the sea shells lie on the very top of the ground? Could it be expected that the fresh water lakes existed at a time before the sea which left my oyster shell rolled over it? That is even so. The fresh water lakes were in the Oligocene, a period earlier than the Miocene. The desert was then the bed of, not the sea, but a vast lake, and at this time it deposited this stratum of shells. If we look through a microscope at this lump from the bottom of Walter's well, we shall find much of it mere infusorial earth, earth made up of particles of many shells. Marine shells have made whole mountain ranges of limestone. The Nummulites, a division of the Rhizopods, formed with their shells in the Eocene period that vast range of

Nummulitic limestone which extends hundreds of miles through the Alps, and it was from this character of limestone that the pyramids of Egypt were built; a square foot of this material, placed under the microscope, shows many millions of shells.

But when the fresh water lakes existed on the Colorado desert, some part of the land, if it was only the coast line, was then higher than the sea. Following this the land sunk, sunk far down, and in flowed the ocean tides; "and the earth was without form and void and the Spirit of God moved upon the face of the waters." But in after ages the ocean floor ceased subsiding and began to rise, and it has been rising ever since. It has not risen evenly all over the desert, for the line near the gulf has moved up and built up by detritus deposits faster than other parts, so that it shut out the sea, leaving large salt water lakes yet upon the desert. These soon evaporated their waters and there remained their minerals crusted upon the bottoms, sometimes, as in the Salton sink, sixty feet below the level of the ocean.

But upon this rising surface came the old shells, came this old Miocene oyster, a part of whose covering I held in my hand, as though to furnish indubitable proofs of conditions long since past.

John E. Bennett.

