

and I am always expecting to see it go. At its feet cluster our bed of Cycads, the latter shaded by young Oreodoxas and Caryotas, and with the margin of the bed fringed by the long feathered leaves, plume-like, of *Phœnix rupicola*. Here and there gleams of silver catch the eye, as the sun, striking on the ornamental stretches of water, glances through the foliage. To the left another member of that beautiful section of the *Rubiaceæ*—the *Nauclea*—occupies a prominent place, its stem the home of the handsome blossoms of *Vanda teres*. The pretty marble pillar and urn to the memory of Col. Kyd is seen through the branches. From it roads lead to the principal landing-stage bordered by Oreodoxas, mahoganies, and our only attempt at ribbon gardening, long lines of *Acalyphas*, &c. Another road, straight for nearly, if not quite, half a mile to one of the exits, has an avenue of *Polyalthia longifolia*, sacred to the Hindoos, and groups of Betle palms; then of Oreodoxas, and lastly of *Inga Saman*. We have great difficulty with the Oreodoxas on account of a beetle that lays its eggs in the terminal buds. Still another road leads to the Orchid House bordered by clumps of graceful bamboos. In the house we generally manage to have a pretty show, and its neighbourhood in the proper season is gay with the blossoms of *Amherstia Gustavia*, *Thunbergia Napoleona*, &c. *Magnolia grandiflora* is flowering with us just now. What a glorious flower it is! Yesterday and the day before there came down on us one of the sudden miniature cyclones that we are so liable to have at the approach of the change of the monsoon. It blew, rained, and hailed tremendously. The trees tossed their arms and wailed, poor things, with such effect that their branches everywhere broke and strewed the ground. However only one small mahogany fell. It was quite cold, and the rain froze, as it was falling, into lumps as big as marbles."

THE EXTINCT LAKES OF THE GREAT BASIN

THE Great Basin of North America presents the most singular contrasts of scenery to the regions that surround it. East of it rise the dark pine-covered heights of the Rocky Mountain system, with the high, bare, grassy prairies beyond them. To the west tower the more serrated scarps of the Sierra Nevada, with the steep Pacific slope on the other side. The traveller who enters the Basin, and passes beyond the marginal tracts where, with the aid of water from the neighbouring mountains, human industry has made the desert to blossom as the rose, soon finds himself in an arid climate and an almost lifeless desert. The rains that fall on the encircling mountains feed some streams that pour their waters into the Basin, but out of it no stream emerges. All the water is evaporated; and it would seem that at present even more is evaporated than is received, and that consequently the various lakes are diminishing. The Great Salt Lake is conspicuously less than it was a few years ago. Even within the short time that this remarkable region has been known, distinct oscillations in the level of the lake have been recorded. There are evidently cycles of greater and less precipitation, and consequently of higher and lower levels in the lakes of the Basin, though we are not yet in possession of sufficient data to estimate the extent and recurrence of these fluctuations.

It is now well known that oscillations of the most gigantic kind have taken place during past time in the level and condition of the waters of the Great Basin. The terraces of the Great Salt Lake afford striking evidence that this vast sheet of water was once somewhere about 1000 feet higher in level, and had then an outflow by a northern pass into the lava deserts through which the cañons of the Snake River and its tributaries wind their way towards the Pacific. Mr. Clarence King, Mr. Gilbert, and their associates in the Survey of the 40th Parallel, threw a flood of light upon the early history of

the lake and the climatic changes of which its deposits have preserved a record. They showed that the present Great Salt Lake is only one of several shrunken sheets of water, the former areas of which can still be accurately traced by the terraces they have left along their ancient margins. To one of the largest of these vanished lakes the name of the French explorer Lahontan has been given. The geologists of the 40th Parallel Survey were able to portray its outlines on a map, and to offer material for a comparison between it and the former still larger reservoir of which the present Great Salt Lake is only a relic. The United States Geological Survey has since begun the more detailed investigation of the region, so that ere long we shall be in possession of data for a better solution of some of the many problems which the phenomena of the Great Basin present. In the meantime Mr. J. C. Russell, who has been intrusted with this work, has written an interesting and suggestive preliminary report of his labours.

The average rainfall of the area of the Great Basin is probably not more than 12 or 15 inches. In the more desert tracts it may not exceed 4 inches, though in the valleys on the borders of the Basin it may rise to 20 or 30 inches. The rain falls chiefly in autumn and winter, consequently many of the streams only flow during the rainy season, and for most of the year present dry channels. Even of the perennial water-courses, the larger part of their discharge is crowded into a brief space towards the end of the rainy season. Most of the streams diminish in volume as they descend into the valleys, and many of them disappear altogether as they wander across the blazing thirsty desert. Loaded with sediment, and more or less bitter with saline and alkaline solutions, they do little to redeem the lifelessness of these wastes.

Over the lower parts of the surface of the Basin are scattered numerous sheets of water. Where these have an outflow to lower levels they are fresh, as in the examples of Bear Lake, Utah Lake, and Tahoe Lake. But the great majority have no outflow. Some of them are merely temporary sheets of shallow water, appearing after a stormy night, and vanishing again beneath the next noon-day sun, or gathering during the rainy season, and disappearing in summer. Yet in some cases these transient lakes cover an area of 100 square miles or more. When they dry up, they leave behind them hard smooth plains of grayish mud, that crack up under the burning sun, and then look like a broken mosaic of marble. Of the permanent lakes the largest is the Great Salt Lake. It is also by much the most saline. Though all of them are more or less charged with alkaline and saline solutions, the percentage of these impurities is in some cases not so great as to prevent the water from being drunk by animals, or even on an emergency by man himself. Nothing in the physics of the Basin is more remarkable than the great diversity in the amount and nature of the mineral substances in solution in the lakes.

The vanished sheet of water, or "fossil lake," as the American surveyors call it, known as Lake Lahontan, lay chiefly in the north-west part of Nevada, but extended also into California. In outline it was exceptionally irregular, being composed of a number of almost detached strips and basins connected by narrow straits, and sometimes separated only by narrow ridges. It inclosed a rugged mountainous island 126 miles long from north to south, and 50 miles broad, which contained two lakes, neither of them apparently overflowing into the main lake. The Central Pacific Railroad passes for 165 miles through the dried-up bed of Lake Lahontan. From the windows of the car one can look out upon the ancient clay floor of the lake and mark the marginal terraces winding with almost artificial precision along the bases of the hills. The larger basins, which were formerly united into one continuous sheet of water, still hold lakes, all of which are more or less saline and alkaline, but they are far from being such concentrated brines as might be

expected were they due to the progressive evaporation of the large original lake.

In tracing back the history of this interesting topography, we are first brought face to face with the fact that the area of the Great Basin has within recent geological times been subject to powerful and long-continued subterranean movements. In numerous cases, rocks have been fractured and displaced to an extent of 4000 or 5000 feet. So recent are some of the fractures that they actually cut through the alluvial cones that stream out from the base of the mountains, and in numerous instances displace the terraces of the old lake to the extent of 50 or 60, or sometimes even 100 feet. There seems no reason to dispute the conclusion to which Mr. Russell and his colleagues have come, that the movements are actually still in progress, and that the constant occurrence of hot springs along the lines of recent fracture may be taken as evidence of the conversion of the subterranean movement into heat.

What may have been the topography of the region before the first depression and isolation of the Great Basin is still unknown. Doubtless the ground had undergone extensive denudation as well as great subterranean disturbance. Considerable irregularities of surface would also necessarily be produced by the intermittent discharge of volcanic rocks. When this uneven floor sank below the level of the surrounding tracts so as to become a basin of inland drainage, a magnificent series of lakes was established. Of these the largest, to which the name of Lake Bonneville has been given, and of which the Great Salt Lake is the diminished representative, covered an area of not less than 19,750 square miles. Lake Lahontan was of hardly inferior dimensions, these two hydrographic basins occupying the whole breadth of the Great Basin in the latitude of the 41st parallel. No fewer than fifteen other smaller basins have been discovered, which, though now either dry or partially covered with saline or alkaline waters, were well-filled lakes at a former period.

It is some years since Mr. Gilbert, from a study of the deposits left by Lake Bonneville, announced his conclusion that they bear testimony to a remarkable oscillation of climate between humidity and aridity. Similar deductions have now been drawn from the deposits of Lake Lahontan. Previous to the appearance of this body of water the climate is believed to have been at least as dry as it is at present, when alluvial cones were pushed outwards from the base of mountains into the area of the future lake. Then came a moist period, when the hollow of Lahontan was filled up with water to a depth of 500 feet above its present desiccated floor in the Carson Desert. At or about this height the water must have stood a long time, for it has deposited, along its rocky margin and round its islets, a thick mass of calcareous tufa. That the water, if not fresh, was at least not so saline as to be inimical to life, is shown by the abundant occurrence in it of fresh-water gasteropods. An epoch of aridity ensuing, the lake fell to so low a level as to become intensely bitter and alkaline, depositing thickly along its margin crystals, six or eight inches long, of gaylussite (a hydrated carbonate of soda and lime). The soda of these crystals having been subsequently removed, the deposit is one of tufa, mainly composed of calcareous pseudomorphs after gaylussite. Next followed a period of increased precipitation, when the lake rose to within 200 feet of its highest level, and when the thickest and most abundant of the tufa deposits of the region was laid down to a depth of sometimes 20 or even 50 feet. This third incrustation of tufa was formed mainly along the rocky shores and islands; but curious mushroom-like protuberances of it likewise gathered upon stones lying on the floor of the lake. The water then rose to the highest level it ever reached, since which time the climate has again become arid. From the fact that the isolated lakes of

the Lahontan Basin are not the saturated alkaline and saline solutions which they would certainly have been had they resulted from the evaporation of such a sheet of water as that in which the three tufa terraces were elaborated, it is inferred that the whole of the original lake was evaporated to dryness, and that its alkalies and salts, having been precipitated at the bottom, were covered over with a layer of mud so as to be partially protected from rapid solution. The existing lakes may thus be supposed to be the result of a subsequent diminution of the extreme aridity, but the time within which they have been in existence has not been long enough to enable them to become as bitter and saline as the original lake.

Such are some of the views which renewed exploration of this weird region has suggested to the able surveyors who have undertaken its investigation. Mr. Russell's report, lucid and interesting as it is, must be regarded as merely a prelude to the fuller results which he and his colleagues are gathering for the good of science, and to the credit of the admirably organised and administered Geological Survey of the United States.

NOTES

PROF. FLOWER, F.R.S., will preside at a meeting which it is proposed to hold on Tuesday next, July 1, in the lecture-room of the Natural History Museum, when Mr. R. Bowdler Sharpe will read a paper on the expediency or otherwise of adopting trinomial nomenclature in zoology. Many British naturalists have been anxious to meet the distinguished American naturalist, Dr. Elliott Coues, who is now on a visit to this country, and to exchange views with him on the subject of nomenclature. Invitations have been sent to a large number of the leading British zoologists, and an interesting discussion is expected.

THE Prince of Wales, President of the City and Guilds of London Institute, opened the Central Institution, Exhibition Road, yesterday afternoon at four o'clock. The Education Section of the International Health Exhibition, in the south wing of the Central Institution, was opened at the same time.

THE following additional donations to the Equipment Fund of the Central Institution of the City and Guilds of London Institute have been voted in response to the appeal of the Prince of Wales:—The Goldsmiths' Company, 4000*l.* (subject to confirmation); the Salters' Company, 525*l.*; the Cordwainers, 250*l.* The Plasterers have increased their annual subscription from 50 guineas to 100*l.*

It is stated that the English Foreign Office is endeavouring to obtain the co-operation of the German Government in the International Educational Conference to be held at the South Kensington Health Exhibition about the middle of August. The Committee attaches special importance to the attendance of representative German pedagogues (this word being used in the higher and German sense) at this conference to read or communicate papers especially on the subjects of technical and secondary education and the organisation of universities; and it is particularly anxious to know, as early as possible, the names of any Germans of note who may be disposed to attend, and the subjects likely to be selected for papers.

A LARGE and influential deputation, including the Earl of Rosebery, the Earl of Fife, Mr. Stephen Williamson, M.P., Hon. R. P. Bruce, M.P., Prof. Cossar Ewart, Prof. Macintosh (St. Andrew's), a number of Scotch M.P.'s, and other gentlemen, waited last Monday on the Home Secretary with the view of impressing on the Government the importance of granting further funds to the Scottish Fishery Board to further scientific investigation into the habits of herring and other food fishes. The principal lines of proposed inquiry are: (1) The examination of the spawning beds around the Scottish coast with the