gathered in the same middle cretaceous strata of 'western Kansas' referred to a moment ago.

Prized more highly than even these, however, are the hundreds of skeletons, or parts of skeletons, of gigantic walking and swimming reptiles, herbivorous and carnivorous, which inhabited the cretaceous ocean, and basked upon the shores of the islands of that age, now forming the heights of the Rockies.

Among the earliest were disclosed wonderfully preserved bones of the class of mosasauroid reptiles, — a group, which, though rare in Europe, here attained an enormous development, both in numbers and in variety of forms. Nearly seventeen hundred individuals, of this kind of giant-reptile alone, stand on the museum's catalogue.

The land-forms were even more terrible to the imagination, though their food was vegetable, and their disposition probably peaceful. One such sauropodan dinosaur shown to the public was sixty feet in length, and in general form came nearer to a crocodile than any thing else. A thigh-bone, lying in an exhibition case, measures six feet in length and is solid; so that it was well able to support the weight of the monster as it rose, kangaroo-fashion, on its hind-legs, to browse its food or to look about it.

In another colossal reptile (Apatosaurus) of nearly equal proportions, one of the neck-vertebrae is shown which is three and a half feet in diameter; while the ponderous bones of Brontosaurus prove, that, when living, the animal must have weighed twenty tons or more. The smallest part of it is the head; the skull and brain being more diminutive, in proportion, than in the case of any other animal now known. It had no weapons of offence or defence, nor even any armor; but in another genus (Stegosaurus) approaching it in bulk, though of more compact form, the body was protected by massive plates, and armed with long spines. This exaggeration of a cross between a snapping-turtle and a hedge-hog possessed a singularity in structure, since in one of the vertebrae of the haunch is a large nerve-cavity, which contained a second or posterior brain, supplementing the extraordinarily small nerve-centre in the skull. This feature has no parallel in the animal kingdom.

To Professor Marsh's personal collection somewhat has been added at the museum by the U. S. geological survey, which will become the publisher of the outcome of his studies now in progress. A score or so of assistants are constantly on duty, either in study, or in the mechanical work of skilfully extracting fossils from the rocky matrix; in matching and mounting by the aid of wire, clay, and plaster, for permanent preservation, the often badly broken bones of some antique brute whose extinction most of the world can accept with resignation; or in making casts, models, and drawings of fossils, original and 'restored.'

Several quarto volumes are already under way; and scarcely an issue of the *American journal of science* appears, without an advance note of some special discovery in vertebrate paleontology, anticipating the completer descriptions to be made from this museum's rich materials. ERNEST INGERSOLL.

RIVER-POLLUTION IN ENGLAND.

AFTER a delay which is much to be regretted, the English government has printed the reports left by Dr. Angus Smith on the working of the Alkali-works regulation act and the Rivers-pollution prevention act. As we mentioned at the time of Dr. Smith's death, he attached great importance to his examination of polluted waters. Great improvements have been effected in lessening the injurious vapors from chemical works. The new works registered are engaged chiefly in the manufacture of sulphate of ammonia and chemical manure. The smaller gas-works have found that they can more profitably manufacture and sell sulphate of ammonia than send their gas-liquor to a distance. The directions in which improvements have latterly been most marked have been in the treatment of sulphuretted hydrogen evolved in the manufacture of sulphate of ammonia, and in the washing of the gases evolved in the treatment of coprolites and other materials at the chemical works. In the former case, oxide-of-iron purifiers have been erected as the best means of preventing the escape of sulphuretted hydrogen; and in some works this gas is now completely burned, instead of being allowed to escape unburnt, up the chimney, as formerly. At others, Claus's method of burning so as to form sulphur, which is collected, and not sulphurous acid, has been adopted. Dr. Smith maintains, that, whatever process be used, the limit of sulphurous acid allowed to escape should not exceed five-tenths of a grain per cubic foot, including the acidity of the coal-smoke itself, which latter varies from a quarter to half a grain. The escapes from sulphuric-acid works have been considerably reduced, in consequence of the introduction of regular testing by manufacturers; and condensers to absorb the nitrous fumes have been put up in a number of nitric-acid works.

Dr. Smith's new method of testing with sugar the amount of organic activity amongst the microbes (at least, of a certain class) which exist in waters was mentioned nearly a year ago in the technical journals. He found that in nearly all natural waters sugar ferments, and hydrogen gas is then given off. So far as

natural waters are concerned, he found the giving-off of hydrogen to be an indication of the presence of microbes, and that the quantity in which the gas is given off appears to increase with the impurity of the water. Thus the waters on the uplands of Derbyshire give off less hydrogen when sugar is added than the same waters taken lower down in the valleys, where sewage enters the brooks. The addition of phosphate to the waters had a powerful stimulating influence; and as the examination of a soil for phosphate is a rather tedious process, and the condition of the phosphate a point difficult to examine, Dr. Smith suggests that his hydrogen process may prove useful in the discrimination of rich and poor soils; also it is a test of the influence of chemical conditions on soils and surfaces. And, obviously, if the giving-off of hydrogen is a test of microbe activity, the process applied to soils may afford a test of the miasmatic condition of particular localities. Indeed, Dr. Smith himself observes that the new light which the process promises to throw upon cases where there is microbe action suggests the examination of so many substances, that 'the end of the inquiry seems far away.' Having stated his results, and their probable immediate practical utility, Dr. Smith presents speculations bearing on ideas which are just now very prominent in the minds of microbiologists. He tells us that he hoped to examine the known microbes of zymotic diseases in order to see if they also produce hydrogen; and he evidently expected to establish a relation in this way between such microbes and the microbes of upland waters. "It is probable," he continues, "that in sewage we have, at some stage or another, the germs of every disease existing in the community, and perhaps, if intensified enough, the germs of every possible disease;" and later on he states the problem still more definitely. Is any germ of disease, he inquires, dangerous or otherwise, according to the conditions to which it is exposed? Is the activity of the microbes found in water diminished by aeration? Are microbes in water of value, and, as they assist in the production of hydrogen when sugar is present, do they assist in digestion, or are they obstacles to digestion? Do the microbes constitute some of the secret qualities of waters which have been found good or evil in the opinion of so many of mankind? In other words, is absolutely pure water wholesome? A curious speculation in which he indulges is, that, given the hydrogen test as a measure of the chemical activity of microbes, we have the basis for calculating the electrolytic power of the movements involved in the life of a single microbe, and thus for arriving at the mechanical equivalent of a disease-germ. In the second part of his water report, Dr. Smith has described additional experiments on the elimination of nitrogen during putrefaction in water, offering further evidence of what he calls the natural purification of waters (first by putrefaction, and then by oxidation) in continuation of the interesting exposition in the report for 1882.

In a third part, Dr. Smith gives the results of a long series of experiments by means of Dr. Koch's gelatine process on samples of water obtained from the most varied sources. The method consists in mixing a purified solution of gelatine with the water experimented upon. In very impure waters the gelatine is first rendered fluid at the surface; and this fluidity gradually increases until the whole becomes fluid. The fluid swarms with bacteria. The results are registered by photographing the test-tubes. It is significant that the results by the gelatine process correspond very fairly with the indications by the hydrogen process, approximate gradations of activity in the same waters being shown by both methods. The value of these investigations will easily be seen.

BARK-LOUSE SECRETION.

THE past summer has been remarkable all through the northern states for the great numbers of large scale or bark lice. These lice have seriously injured our maples, white ashes, hickories, sassafrases, tulips, and elms. The eggs of these coccids hatch in May and June. The young lice attach their force-pumps beneath the leaves, where they sap the vigor of the trees the summer through. As the drying-up of the leaves in autumn gives a prophecy of a weakening stem, and prospective fall of the leaves, the lice desert the leaves, and attach their suction-pumps to the under side of the twigs and branches. I found that I could, by plucking the branches, hasten the migration of these lice from leaves to stem. The premature drying of the leaves caused the premature emigration of the lice. In early spring the scales — for now the lice are plump, scale-like creatures — grow very fast; and so rapid is the nectar secretion which exudes from the lice, that the leaves twinkle and fairly drip with this bark-louse nectar. The grass and walks beneath the trees become sticky with the unctious sweet.

The species of coccid which infests the maples secretes a cotton-like, fibrous mass, in which the eggs to the number of seven hundred or eight hundred are placed. This cotton-like nidus pushes out from behind, and raises the scale from the branch. In other species the hundreds of white eggs are concealed beneath the brown scales.

The nectar from these bark-lice is dark in color, of rank odor, and bitter and unpleasantly pungent to the taste. Though the bees appropriate this secretion, they refuse it entirely when they can gather from flowers. In actions they say, 'Better this than none, but never this when other is possible.' The bees regard this questionable sweet just as they do grape-sugar, — only to be accepted in lieu of naught else. The odor of this nectar is so rank; that its presence on trees is often quickly detected when one passes by. In many sections the past season the bees gathered this liquid by tons. I know of cases where the odor in the apiary was so strong that the bee-keepers thought they were victims to that terrible fungoid malady, 'foul brood,' which bee-disease is indicated by a nauseating stench.

This bark-louse nectar presents a strong contrast