

# SCIENTIFIC AND SANITARY.

## THE WEEK.

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### WHY IS SEA-WATER SALT?

This question has been regarded as a mystery, and has given rise to some curious speculations, but a little consideration of the subject must, I think, satisfy us all that it would be very wonderful, quite incomprehensible, if the waters of the ocean were otherwise than salt as they are.

The following explanation was first suggested to myself many years ago, when receiving my first lessons in practical chemical analysis. The problem then to be solved was the separation of the bases dissolved in water by precipitating them, one by one, in a solid condition; filtering away the water from the first, then from this filtrate precipitating the second, and so on, until all were separated or accounted for.

But in doing this there was one base that was always left to the last, on account of the difficulty of combining it with any acid that would form a solid compound, a difficulty so great that its presence was determined by a different method. This base is soda, the predominating base of sea-salt, where it is combined with hydrochloric acid. Not only is soda the most soluble of all the mineral bases, but the mineral acid with which it is combined forms a remarkably soluble series of salts, the chlorides. Thus the primary fact concerning the salinity of sea-water is that it has selected from among the stable chemical elements the two which form the most soluble compounds. Among the earthy bases is one which is exceptionally soluble—that is, magnesia,—and this stands next to soda in its abundance in sea-water.

Modern research has shown that the ocean contains in solution nearly every element that exists upon the earth, and that these elements exist in the water in proportion nearly corresponding to the mean solubility of their various compounds. Thus gold and silver and most of the other heavy metals are found to exist there. Somewhat found about 14 grains of gold to the ton of sea-water, or a dollar's worth in less than two tons.

As the ocean covers all the lower valleys of the earth, it receives all the drainage from the whole of the exposed land. This drainage is the rain-water that has fallen upon this exposed surface, has flowed down its superficial slopes, or has sunk into porous land, and descended under-ground. In either case the water must dissolve and carry with it any soluble matter that it meets, the quantity of solid matter which is thus appropriated being proportionate to its solubility and the extent of its exposure to the solvent. Rain when it falls upon the earth is distilled water nearly pure (its small impurities being what it obtains from the air), but river-water when it reaches the ocean contains measurable quantities of dissolved mineral and vegetable matter. These small contributions are ever pouring in and ever accumulating. This continual addition of dissolved mineral salts, without any corresponding abstraction by evaporation, has been going on ever since the surface of the earth has consisted of land and water.

An examination of the composition of other bodies of water, which, like the ocean, receive rivers or rivulets and have no other outlet than that afforded by evaporation, confirms this view. All of these are more or less saline. On the great Table Land of Asia, "the roof of the world," there is a multitude of small lakes which receive the waters of the rivers and rivulets of that region and have no outlet to the ocean. On a map they appear like bags with a string attached, the bag being the lake and the string the river. All these lakes are saline, many of them excessively so, simply because they are ever receiving river-water of high salinity, and ever giving off vapour which has no salinity at all. There is no wash through those lakes as in the great American lakes or the Sea of Constance, Geneva, etc.

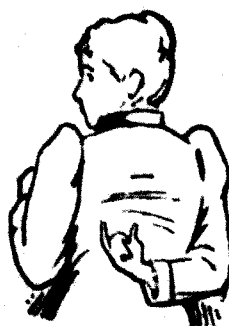
The Sea of Aral and the Caspian are lakes without any other outlet than evaporation, and

they are saline accordingly. The Dead Sea, which receives the Jordan at one end and a multitude of minor rivers and rivulets at its other end and sides, is a noted example of extreme salinity. It is, as everybody knows, a sea or lake of brine. The total area of land draining into the great ocean does not exceed one-fourth of its own area, while the Dead Sea receives the drainage and soluble matter of an area above twenty times greater than its own, and thus it fulfils the demand of the above-stated theory by having far greater salinity than has the great ocean.

According to this view the salinity of the ocean must be steadily, though very slowly, increasing, and there must be slowly proceeding a corresponding adaptation or evolution among its inhabitants, both animal and vegetable. The study of this subject and the effect which the increasing salinity of the past must have had upon the progressive modifications of organic life displayed by fossils is, I think, worthy of more attention than it has hitherto received from paleontologists. —W. Matthew Williams, F.R.A.S., F.R.S., in Science.

At the recent International Congress of Physiology at Liege, Professor Herman demonstrated his method of photographing the sound of vowels. The vowels were sung out before one of Edison's phonographs. Immediately afterwards they were reproduced very slowly, and the vibrations recorded by a microphone. The latter was furnished with a mirror, which reflected the light of an electric lamp upon a registering cylinder, covered with sensitized paper and protected by another cylinder with a small opening which gave passage to the rays of light from the reflector. By this means was obtained very distinct photographic traces, and the constancy was remarkable for the different letters. —Scientific American.

The attempt has been made by sundry champions of the Church to show that some of Bacon's utterances against ecclesiastical and other corruptions in his time were the main cause of the severity which the Church authorities exercised against him. This helps the Church but little, even if it be well based, but it is not well based. That some of his utterances of this sort made him enemies is doubtless true, but the charges on which St. Bonaventura silenced him, and Jerome of Ascoli imprisoned him, and successive popes kept him in prison for fourteen years, were "dangerous novelties" and suspected sorcery. Sad is it to think of what this great man might have given to the world had ecclesiasticism allowed the gift. He held the key of treasures which would have freed mankind from ages of error and misery. With his discoveries as a basis, with his method as a guide, what might not the world have gained! Nor was the wrong done to that age alone; it was done to this age also. The nineteenth century was robbed at the same time with the thirteenth. But for that interference with science the nineteenth century would be enjoying discoveries which will not be reached before the twentieth century. Thousands of precious lives shall be lost in this century. Tens of thousands shall suffer discomfort, privation, sickness, poverty, ignorance, for lack of discoveries and methods which, but for this mistaken dealing with Roger Bacon and his companions, would now be blessing the earth. In two recent years sixty thousand children died in England and in Wales of scarlet fever; probably quite as many died in the United States. Had not Bacon been hindered, we should have had in our hands, by this time, the means to save two-thirds of these victims; and the same is true of typhoid, typhus, cholera, and that great class of diseases of whose physical causes science is just beginning to get an inkling. Put together all the efforts of all the atheists who have lived, and they have not done so much harm to Christianity and the world as has been done by the narrow-minded, conscientious men who persecuted Roger Bacon, and closed the path which he gave his life to open. —From Magic to Chemistry and Physics, by Dr. Andrew D. White, in the Popular Science Monthly.



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