point attained was lat. 86° 14′, which is nearly 200 miles further north than had previously been reached. No land was sighted north of 82°. Dr. Nansen and his companion then went south to Franz Josef Land, where they passed the winter, subsisting on bears flesh and whale blubber. Here they fell in with the *Windward*, of the Jackson-Harmsworth expedition, which brought them to Vardö. It is expected that the *Fram* will eventually arrive at Spitbergen.

With most commendable enterprise, the *Daily Chronicle* published on Saturday, August 15, Dr. Nansen's own narrative of his expedition, telegraphed from Vardö. The narrative is in the highest degree interesting, as well as a striking testimony to the hardihood and indomitable spirit of Dr. Nansen and Lieut. Johansen, who for seventeen months, cut off from all means of retreat, travelled over nearly 700 miles and carried on polar explorations. The telegram published in the *Daily Chronicle* is abridged below; and we are glad to express our acknowledgments to that newspaper for the opportunity afforded us of placing before the readers of NATURE the salient points in this account of Dr. Nansen's explorations of polar regions.

The *Fram* left Jugor Strait August 4, 1893. We had to force our way through much ice along the Siberian coast. We discovered an island in the Kara Sea, and a great number of islands along the coast to Cape Cheljuskin. In several places we found evidences of a glacial epoch, during which Northern Siberia must have been covered by inland ice to a great extent.

On September 15 we were off the mouth of Olenek River, but thought it too late to go in there to fetch our dogs, as we would not risk losing a year. We passed the New Siberian Islands on September 18.

On September 22 we made fast to a floe in latitude 78° 50′ N., and longitude 133° 37′ E., and allowed the ship to be closed in by the ice.

As anticipated, we were gradually drifted north and north-westward. The sea was up to ninety fathoms deep south of 19° N., where the depth suddenly increased, and was from 1600 to 1900 fathoms north of that latitude. This will necessarily upset all previous theories based on a shallow Polar Basin. The sea-bottom was remarkably devoid of organic matter. During the whole drift I had good opportunities to take a series of scientific observations—meteorological, magnetic, astronomical, biological soundings, deep-sea temperatures, examinations for salinity of the sea-water, &c. Under the stratum of cold ice-water covering the surface of the Polar Basin, I soon discovered the warmer and more saline water due to the Gulf Stream, with temperatures from 31° to 33°. We saw no land, and no open water, except narrow cracks, in any direction.

As anticipated, our drift north-westward was most rapid during the winter and spring, while northerly winds stopped or drifted us backwards during the summer. On June 18, 1894, we were on 81° 52′ N. lat., but drifted then southward only. On October 21 we passed 82°. On Christmas Eve, 1894, latitude 83° N. was reached, and a few days later 83° 24′, the farthest north latitude previously reached by man.

As I anticipated that the *Fram* would soon reach her highest latitude to the north of Franz Josef Land, and that she could not easily fail to carry out the programme of the expedition, viz. to cross the unknown Polar Basin, I decided to leave the ship in order to explore the sea north of her route. Lieut. Johansen accompanied me. On March 3 we reached 84° 4′ N. Johansen and I left the *Fram* on March 14, 1895, at 83° 59′ N. lat., and 102° 27′ longitude East of Greenwich. Our purpose was to explore the sea to the north, reach the highest latitude possible, and then go to Spitzbergen *viâ* Franz Josef Land, where we were certain to find a ship.

On March 22 we were on 83° 10′ N. lat. The ice now became rougher, and the drift contrary. On April 3 we were at 85° 50′ N., constantly hoping to meet with smoother ice. On April 4 we reached 86° 3′ N., but the ice became rougher, until on April 7 it got so bad that I considered it unwise to continue our march in a northerly direction. We were then at lat. 86° 14′ N.

I then made an excursion on *ski* further northward in order to examine the possibility of further advance, but I could see nothing but ice of the same description, hummock beyond hummock to the horizon, looking like a sea of frozen breakers, the whole time. We had had a low temperature during nearly three weeks; it was in the neighbourhood of 40° below zero. On April 1 it rose to 8° below, but soon sank again to 38°. The minimum in March was 49° and the maximum 24°. In April the minimum was 38° and the maximum 20°.

On April 8 we began our march towards Franz Josef Land. On April 12 our watches ran down, and we were after that date uncertain of our longitude, but hoped that our dead reckoning was fairly correct. We expected daily to find land in sight, but we looked in vain.

On May 31 we were in 82° 21′ N.; on June 4 in 82° 18′ N.; but on June 15 we had been drifted north-west to 82° 26′. No land was to be seen, although, according to Payer's map, we had expected to meet with Petermann Land at 83° N. These discrepancies became more and more puzzling as time went on.

We did not reach land until August 6, at 81° 38′ N. lat. and about 63° E. long. This proved to be entirely ice-capped islands. In our "kayaks" we made our way westward in open water along these islands.

On August 12 we discovered land extending from south-east to north-west. The country became more and more puzzling, as I could find no agreement with Payer's map. I thought we were in a longitude east of Austria Sound; but if this were correct, we were now travelling straight across Wilczek Land and Dove Glacier, without seeing any land near us.

On August 26 we reached a spot in 81° 13′ N. and 56° E., where we wintered. The spring came with sunshine and much open water to the south-west, and we hoped to have an easy voyage to Spitzbergen over floe ice and open water. On May 19 we were at last ready to start, and came to open water on May 23, in 81° 5′ N., but we were retarded by storms until June 3. A little south of 81° we found land extending westward, and the open water reached west-north-west along its north coast. But we preferred to travel southward over ice through a broad Sound. We came on June 12 to the south side of the islands, and found much open water, trending westward. We sailed and paddled in this direction in order to proceed across to Spitzbergen from the most western cape, but Payer's map is misleading.

We left Franz Josef Land in the *Windward* on August 7, and had a short and very pleasant passage, thanks to the masterly way in which Captain Brown brought his ship through the ice, and thence in the open sea to Vardö.

## BACTERIA AND CARBONATED WATERS.

THE new methods of bacteriological research were early called into requisition to determine what hygienic importance from a bacterial point of view could be ascribed to the gaseous aëration of water.

A large number of experiments have from time to time been carried out, and various points of interest have been investigated, but nevertheless considerable divergence of opinion exists as to the precise hygienic value with which the carbonation of water can be credited.

Some authorities state that in such waters the number of bacteria steadily declines, whilst others again have observed as distinct a multiplication of the bacteria present.

The possibility of these two contingencies is, however, quite conceivable without necessarily impugning the accuracy of the results obtained in either case. In the first place it must be remembered that widely different types of water serve for the manufacture of artificial aërated waters, the bacterial contents of which are likewise widely divergent both qualitatively and quantitatively.

Here, then, in the first instance is a source of discrepancy, for the behaviour of bacteria in carbonated waters, as also under other conditions, primarily depends upon the particular varieties of bacteria which have to be dealt with.

It has been shown that whereas some bacteria rapidly disappear in aërated waters, others again are endowed with fabulous powers of multiplication and longevity.

Thus in one instance a sample of carbonated water was found to contain, one hour after its manufacture, 8350 microbes per cubic centimetre; these figures rose, however, after the lapse of 210 days, to the considerable number of 212,400 per c.c.; later on, however, at the end of 428 days, there were only 46 per c.c.

Again, as regards the duration of vitality of ordinary water microbes under these circumstances, we read of as many as 91 being found per c.c. in a sample of water which was considerably more than two years old.

It is obvious, therefore, that as regards the bacterial contents of a particular sample of aërated water, the results are in the first instance dependent upon the bacterial quality of the original water employed, and the nature of the particular microbes present, whilst it must be acknowledged that a considerable element of chance is introduced into the results, inasmuch as they so greatly depend upon the time at which the examination happens to be made.

Thus in the above example, where such enormous multiplication was observed, no one would hesitate, on the strength of such figures, to condemn that water from a bacterial point of view, whilst if its examination had been longer postponed until it yielded only 46 microbes per c.c., as unhesitating a favourable verdict might have been pronounced upon it. As regards the influence of the bacterial purity of the original water upon the finished article, we have frequent evidence of the paucity of bacteria present when the raw water employed has been deprived of all microbial life by boiling or distillation; but even when such precautions are taken in the first instance, we often find that very considerable numbers of bacteria are present in this water after aëration, a fact which is to be ascribed to the bacterial contamination which subsequently obtains in the process of manufacture. Such contamination may be due to various causes; the storage of the water in reservoirs in the factory has been shown in some cases to be responsible for this result, whilst Dr. Abba has recently called attention to the condition of the bottle-syphons used for the distribution of aërated waters as frequently contributing to bring about this condition of things.

These syphons, he states, in his important report on the aërated waters supplied to Turin, are not only left unsterilised after use, but they are neither washed out nor even emptied completely; hence a deposit is always present, which furnishes ample material for the bacterial contamination of the freshly added water. Another factor which controls to a certain extent the bacterial contents of aërated waters is the amount of carbonic anhydride which is present. This point has been well illustrated by Slater, and Dr. Abba has confirmed his results. Thus:—

| Amount of carbonic anhydride present per litre. (Grammes.) | Bacteria per c.c. |
|---|---|
| 15·08 | 299 |
| 12·10 | 388 |
| 11·74 | 435 |
| 9·07 | 1207 |
| 8·01 | 1354 |
| 6·90 | 1580 |
| 6·03 | 2032 |

Whether the above rise in the bacterial contents on the release of the gas present is due to the diminution of the pressure or to the specific action of the gas being modified, it is difficult to say; probably both causes co-operate in bringing about the result. At present we have no authoritative experimental observations to decide this point.

That carbonic anhydride is capable of exercising very specific action in the case of some micro-organisms in the absence of pressure, was shown some years ago by Dr. Percy Frankland in his experiments on the influence of carbonic anhydride and other gases on the development of micro-organisms (*Proc. Roy. Soc.*, 1889). Three microbes were experimented with—Koch's cholera bacillus, Finkler-Prior's bacillus, and the *Bacillus pyocyaneus*, an organism frequently found in green pus.

These bacteria were exposed on gelatine surfaces to the action of the gas in closed vessels, and after a time they were transferred to vessels containing air only.

In the case of Koch's bacillus and Finkler-Prior's bacillus, no growth whatever appeared in the carbonic anhydride vessel, neither did any sign of vitality make its appearance when the bacilli in question were subsequently transferred to the air vessel.

The case was, however, different with the green-pus bacillus, for although no growths appeared in the presence of the gas, on being removed to the air-vessel, growths did manifest themselves, showing that the carbonic anhydride had not succeeded in destroying the bacilli as it had done the two others.

Here, then, we have an example of the specific action of the gas being controlled by the character of the particular microbe to be dealt with. Some authorities ascribe the action of carbonic anhydride simply to the bacteria being deprived of oxygen by its means, but the absence of oxygen can also not be held entirely responsible for the deleterious action of carbonic anhydride; thus, in an atmosphere deprived of oxygen by means of hydrogen, Dr. Percy Frankland found that the growth of Koch's cholera bacillus was not interfered with at all, but we have seen how fatally it was affected in the absence of oxygen by the carbonic anhydride. Here, then, clearly the presence or absence of oxygen would appear to have no voice in the results obtained.

As regards the behaviour of pathogenic bacteria in carbonated waters, the results so far obtained are decidedly more unanimous.

There is no doubt that a very general impression prevails that a barrier of no mean obstructive power is placed between the consumer and zymotic disease, by the substitution of aërated waters for ordinary drinking-water, at any rate during times of epidemics.

This impression is to a certain extent justified by investigation, but can at the same time only be encouraged to a moderate extent, as the following researches will sufficiently show.

When anthrax bacilli are introduced into ordinary seltzer water, they do not live more than from fifteen minutes to one hour; when the spores, however, are similarly treated, they survive upwards of 154 days.

As, however, anthrax in the condition of bacilli devoid of spores is only very exceptionally met with, we cannot derive much comfort from using seltzer water; fortunately, however, so far the communication of anthrax is not associated with drinking-water, and from a hygienic point of view the above results may be regarded as of, perhaps, more theoretical than practical interest.

Our position with reference to cholera germs and water is, however, on quite a different footing, and it is extremely reassuring to learn, on the authority of such investigators as Hochstetter, Slater, and Abba, that in ordinary seltzer and soda water, cholera bacilli cannot live longer than three hours. Dr. Abba records some curious results, in which he states that in *sterilised* tap-water gaseously aërated cholera bacilli persisted as long as forty-eight hours, whilst if such sterilised aërated water is rendered alkaline by the addition of 1 per 1000 bicarbonate of soda, their life was prolonged for as much as twelve days.

It would appear that sterilisation, or the removal of competing water bacteria, materially assisted the life of cholera bacilli; and this impression is confirmed by another experiment with alkalised water, in which the water was not sterilised first, and in which the vitality of the bacilli, instead of reaching twelve, was cut down to seven days.

Unfortunately, as regards typhoid infected water, we cannot resort with any degree of security to carbonated waters, unless we have proof that the manufactured article has been stored for at least a fortnight before use.

Slater observed typhoid bacilli alive in ordinary aërated water as long as eleven days, and both Abba and Hochstetter record a vitality of five days. In some cases, however, they appear to disappear much more rapidly, and doubtless a great deal depends upon the initial vital condition of the particular cultivation of typhoid bacilli employed.

Here again Dr. Abba finds in *sterilised*, alkalised, aërated water, that the persistence of the typhoid bacilli is superior to that observed in similar waters not deprived of their bacterial life.

Dr. Abba has also experimented in a similar manner with the *B. coli communis*, and finds that, beyond its exhibiting the customary character of superior hardiness under adverse circumstances to its near relative, the typhoid bacillus, its behaviour resembled that of the latter. Although storage even for such considerable periods of time as over two years cannot, as we have seen—at any rate in some cases—secure the entire elimination of ordinary water microbes, yet storage of considerably shorter duration is of undoubted service in the destruction of disease germs, as far as our information at present goes.

It would appear reasonable, therefore, to make a practice of storing such waters before distribution, a measure recommended many years ago by Duclaux, and which, in the absence of preliminary precautions, such as the removal of all bacteria present by boiling, distillation or efficient filtration, would appea to be a measure of great hygienic importance.

G. C. FRANKLAND.