men had a larger number of genuine admirers, or gathered around them a wider circle of sincere and attached friends. And not alone to the fields in which he himself worked did he extend his interest and sympathies. Amid the labourers in very different departments of thought he found some of his most cherished friends—frequent and always welcome guests at his hospitable home. For these, and for all who had enjoyed the privilege of his friendship, the sorrow at his loss will be softened by the ennobling memory of his life.

GEO. J. ALLMAN

BRITISH ASSOCIATION, SECTION B: DISCUSSION ON THE NATURE OF SOLUTION

IT may perhaps be convenient to those chemists who have announced their intention of joining in the proposed debate in Section B, at the approaching meeting of the British Association, that, having accepted the invitation of the President to open the discussion, I should indicate briefly the general nature of the subjects upon which I shall offer some remarks, and the order in which I shall probably take them.

After an historical sketch of the theories which have been framed with the object of explaining the constitution of saline and other solutions, the phenomena of solution will be dealt with somewhat as follows :—

Thermal and volume changes occurring in the act of solution and their mutual relations. How far and under what circumstances are thermal and volume changes to be considered as indicating chemical change?

The molecular volumes of salts in solution. The specific heat and vapour pressures of salt solutions. The relation of solubility to molecular volume, to fusibility, and to the composition of the liquid.

Action of solids and especially of porous bodies on solutions. Phenomena of supersaturation.

What is chemical combination, and is there any criterion by which it may be distinguished from adhesion or mechanical combination?

In consequence of the very wide-reaching character of the subject, it will not be possible to take up the question of solution except as relating chiefly to solids, and especially salts, in water. For the same reason I cannot fully discuss the phenomena of absorption-spectra nor generally the action of solutions upon light, but I hope some of those chemists who have worked on this part of the subject will be present, and will give us the benefit of their experience.

There will of course be a great number of questions incidentally touched upon in my opening, which may well form the basis of remarks from other speakers, such as—

How is saturation to be explained, *i.e.* why is there generally a limit to solubility?

Is there any general connection between solubility and atomic weight in a series of compounds in which only one constituent varies?

What becomes of water of crystallisation when a salt containing water is dissolved in water?

WILLIAM A. TILDEN

The Mason College, Birmingham

THE RECENT VOLCANIC ERUPTIONS IN NEW ZEALAND

WE have been favoured by Dr. Hector, F.R.S., Director of the Geological Survey of New Zealand, with a copy of a Preliminary Report drawn up by him for the New Zealand Government regarding the volcanic eruptions of last June in the North Island. It is gratifying to find that the hope expressed in NATURE (p. 322) has been so promptly fulfilled, and that the investigation of the remarkable phenomena has been undertaken by so competent an observer as Dr. Hector. The following is his Report, but it is merely a preliminary outline, and will no doubt be followed by much ampler details.

"*Colonial Museum of New Zealand, Wellington, June* 23, 1886

"According to instructions from Government, I proceeded to Tauranga on the evening of Thursday, the 10th instant, in the colonial gunboat *Hinemoa*, and arrived there on Saturday afternoon. At Tauranga I engaged the services of Mr. Spencer, a skilful landscape photographer, and on Sunday our party, seven in number, drove to Rotorua by the Oripi Road, the ordinary route by Te Puke being blocked On Monday I proceeded to Wairoa with Captain Mair, who joined the boat expedition which had been organised to search the Native settlements on Tarawera Lake. On the same day I sent my assistant, Mr. Park, to the south of the disturbed area by way of Kaiteriria; and on Tuesday, following the same route, I examined the vicinity of Rotomahana. Mr. Spencer, with his camera, accompanied me everywhere, so that a series of well-selected views of the eruption and its effects was obtained. On Wednesday we started for Taupo, feeling anxious to complete the general view of the whole line of volcanic activity from Ruapehu to White Island, as alarming rumours were in circulation as to the extent of country that had been affected. By this route we also obtained a distant but interesting view of the newly-raised cones of Tarawera from the eastward. The incidents of the eruption have been so fully described by the Press that it is unnecessary for me to refer to them in this preliminary report, the chief object of my rapid inspection having been to ascertain the exact locality, nature, and extent of the outbreak, and its probable consequences to the district. A complete geological examination of the district has therefore been deferred until a more favourable season for field-work, and until the volcanic activity has sufficiently subsided to admit of accurate observation.

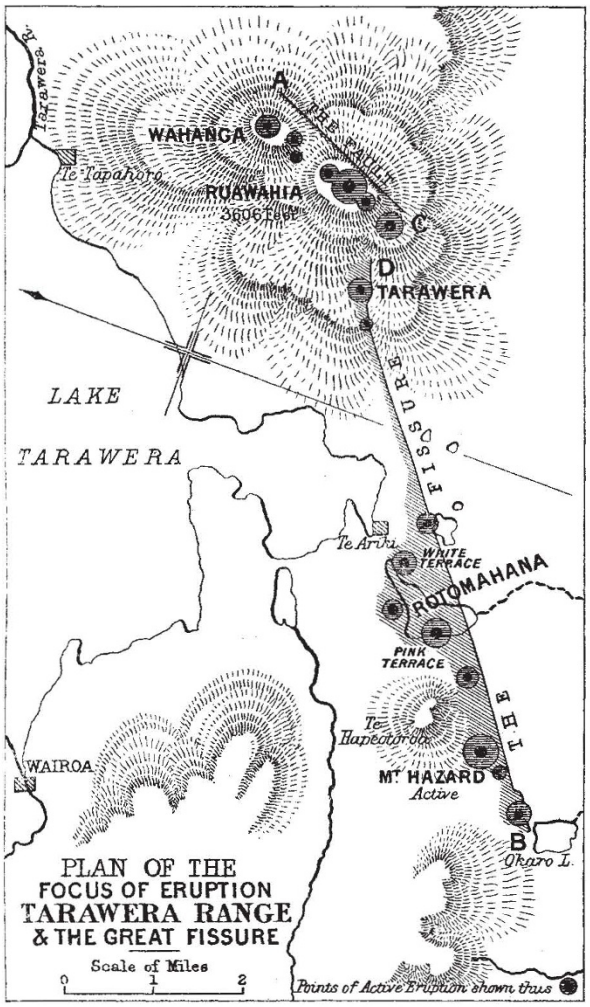
"The focus of the disturbance was ascertained to be in a line extending from seven to ten miles in a north-east to south-west direction from the north end of the Tarawera Range to Okaro Lake (see plan.) The northern part of this line is occupied by the Tarawera Range. This range has three summits, the northernmost being Wahanga; the central, Ruawahia, 3606 feet alt.; and the southernmost, Tarawera Mountain proper. The southern part of the line previous to the outburst was a depression occupied by Rotomahana Lake, surrounded by low undulating country composed of pumice-sands and overspreading deposits of siliceous sinter, most of which were connected with active geysers, amongst which the most famous were those at the Pink and White Terraces.

"From the most reliable evidence it appears that the outbreak commenced at ten minutes past two on the morning of the 10th, by an eruption from the top of Wahanga, attended by a loud roaring noise, and slight earth-shocks. In a few minutes this was followed by a similar but more violent outburst from the top of Ruawahia—the middle peak of the range, and after a short interval this phase of the eruption culminated in a terrific explosion from the south end of Tarawera Range, north-east of Lake Rotomahana. For nearly two hours this was the only phase of the eruption, and was accompanied by the ejection of vast quantities of steam, pumice-dust, and hot stones, forming huge towering clouds, illuminated by lightning flashes.

"It was at this time also that a great crack or fissure (A C on plan) was formed along the east face of the Tarawera Range. I only had a distant view of this fissure from the eastward, but Mr. Percy Smith, the Assistant Surveyor-General, who had a near view from the sides, reports that the whole east end of the mountain

has been blown away, and that the *débris* covers the country to a distance of many miles. The white terrace of pumice-sand that I saw was singularly flat-topped, and seemed to slope abruptly from the mountain like a huge embankment 500 feet high. Besides these heavy sands that lodged close to the fissure in the mountain side, the lighter dust was spread out in the form of stratified clouds, which were distinctly seen, at this period of the eruption, from Rotorua, Tauranga, and Taupo.

"The cloud thus formed discharged its contents for the greater part in a direction to the eastward of the mountain, reaching as far as Te Teko and Fort Galatea, and to the westward as far as Wairoa. The earth-shocks, however,



during this period of the eruption do not appear to have been of extreme violence, or to have created much alarm beyond that part of the district lying in the immediate vicinity of the volcanic eruption; but shortly before four a.m. a violent outburst of a totally different nature was experienced, accompanied with loud reports that reverberated through the atmosphere to enormous distances. The first notice of this outbreak was an earth-shock that appears to have been much more widely felt than those previous, and chiefly in areas where hot springs occur. This development was attendant on the outburst of an immense volume of steam—carrying pumice-dust and fragments of rocks to an enormous altitude—which proceeded from the site of Rotomahana Lake, causing the formation of a dense cloud in the higher atmosphere, that spread in definite directions, its advancing edge being marked by electrical discharges of the most awe-striking character. At first the wind was from the south-east, and the inhabitants of Rotorua appear to have been terrified by the approach of this hideous cloud, when suddenly the wind sprang up from the south-west and arrested its progress in that direction, turning it off towards the north-east, at the same time condensing the vapour of the cloud to such an extent that the suspended solid matter dropped on the surface of the earth in the form of mud, smothering the country, and leading to the disastrous results experienced at Wairoa. By six a.m. the period of active eruption appears to have closed, and since then the display of energy in a modified form has also rapidly declined.

"The following are the chief points which require notice in this report:—

"I. *Focus.*—Tarawera Range, about 3600 feet above sea-level, is an isolated and very conspicuous object in the scenery of the Lake District. It slopes from the east side of Tarawera Lake—the level of which is about 1000 feet above the sea—and previous to the eruption rose very abruptly, with mural precipices and columnar rocks, especially on its western and southern escarpments. It was no doubt judging from this feature that Dr. Von Hochstetter was led to class Tarawera Mountain with the Horohoro Range, as being part of his older or submarine-formed volcanic series, and a remnant of the great plateau (Von Hochstetter, "Reise der Novara," i. 106), the surface of which denotes the original level of the country prior to the production of its present broken surface by the excavation of valleys, by the up-bursting of volcanic mountains, and the consequent subsidence or breaking-in of large cavities that are now occupied by lakes. He nevertheless maps Mount Tarawera as belonging to his recent volcanic group, and also alludes to it in other parts of his work as being largly composed of obsidian. I have never ascended the Tarawera Range, but have examined its slopes and found them to be composed of lavas of a high acidic or rhyolite type, in the form of flows intersected by dykes, and containing, amongst other rocks, large quantities of compact and vesicular obsidian. From this I conclude that the mountain really is one of recent volcanic origin, belonging to Von Hochstetter's new volcanic series, and that its abrupt outlines have resulted from fractures and subsidences of its flanks. According to this view it is natural to assume that the still-imperfectly-cooled mass of lava in the heart of this volcanic mountain has given rise to the long-continued (historically speaking) solfatara action at high temperatures that created the attractive wonders of the Rotomahana. It has been stated that no Native tradition exists of Tarawera having been the site of previous activity, but the range culminates in three distinct peaks, the meaning of the Maori names of which—according to Mr. Locke, M.H.R., and other authorities—clearly contradicts this assumption. This consideration has interest, as a sudden development of volcanic activity in a new locality, or in an ancient and greatly-denuded formation like the trachyte breccia that forms the Horohoro, would have been more serious and significant than the mere temporary revival of the expiring energies of a recent focus of volcanic force.

"II. *The Vents.*—As viewed across Rotorua Lake, on the 13th, from the point where the Tauranga Road emerges from the bush, Tarawera Range appeared to have quite lost its former characteristic outline. The deep gap dividing Wahanga, the northern peak, from Ruawahia, the central one, was almost obliterated, and the abrupt, precipitous sides of the mountain were everywhere softened by great slope deposits of material ejected from the volcanic vents, consisting of stones and dust of a grey colour. Along the edge of the range seven distinct

points were seen to give off steam from flattened conical heaps of dark-coloured *débris*, and at intervals these vents threw off large volumes of steam and vapour, darkened to a reddish hue by solid matters, which were discharged to a height estimated at from 200 feet to 500 feet. Four days later, when viewed from the eastward, the same range showed a similar appearance, allowing for the change in direction; but the cone on the summit of Ruawahia had evidently accumulated with greater rapidity than the others, and had acquired lateral cones, giving its outline a similar appearance to that of Rangitoto, near Auckland.

"During two clear nights I watched the eruption from these vents, and could distinguish them against the sky with a powerful binocular telescope; but I never observed any illumination of the ascending steam clouds, as if from the surface of an incandescent mass within the vent, nor was there any sign of any outpouring of lava, either from these vents or from cracks or fissures in the sides of the mountain, during the time of my visit. In addition to the above-mentioned conical vents on the summit of the range, along its eastern side the line of fissure already alluded to was distinctly visible, emitting wreaths of steam. This line of fissure lay in an oblique direction, so that it appeared to gain in elevation along the sides of the mountain from north towards south, but not sufficiently so as to indicate for it a direction that would make it continuous with the great fissure south of Tarawera, but rather in the direction of line A C on plan. It is below this fissure-line on the eastern flank of the range that bulky terrace-like accumulations of pumice-sand have been formed, and if this eruption should ever reach the stage of producing lava, which from other circumstances I think hardly likely, it is from this fissure that I should expect the lava to exude.

"III. *The Great Fissure.*—This is the most remarkable and characteristic feature of the late eruption, and the chief origin of the disastrous results which attended it (B D on plan). A good view, but much obscured by steam, was obtained from the hill called Te Hape-o-Toroa —alt. 2300 feet—by Mr. Park on the 14th, and by myself on the following day. This fissure seems to commence as a narrow rift at the northern end from the great rent which has been formed in the south end of Tarawera Mountain. This rent is a most wonderful feature. It is not a slip from the mountain side, but appears as if a portion of the mountain measuring 2000 feet by 500 feet, and 300 feet deep, had been blown out, leaving a ragged, rocky chasm, from which steam was being discharged in rapidly-succeeding puffs. The eastern side of this chasm was brightly tinted, as if by the efflorescent deposit of a mineral substance, probably ferrochlorides. Sulphur has been mentioned as a deposit from this recent outburst by some who have witnessed it; but this is hardly a possible result of such rapid volcanic developments.

"The view I obtained of the extent of this chasm south was much obscured by numerous volumes of steam blowing off from the newly-formed fumaroles that occupied the site of Rotomahana. From the eastern slope of Te Hape-o-Toroa we looked right into the fissure, and, as far as I could see, it appeared to have a nearly straight boundary of undisturbed ground on its eastern side, extending from the Tarawera chasm to within a few chains of Lake Okaro, thus intersecting the Rotomakariri or the cold lake, the Rotomahana Lake, and the valley extending from thence southward. The west side of the fissure, on the other hand, is very irregular in outline, and is continually being altered by the falling-in of its precipitous walls, as the hills are undermined by the action of powerful geysers, seven in number, which at irregular intervals throw up great volumes of boiling water, with stones and mud, to a height of 600 feet to 800 feet from the bottom.

"It is only by occasional glimpses during the breaks of the steam that any idea can be formed of the nature of the bottom of this huge fissure; but it seemed as if it was entirely occupied by large circular areas of mud, seething and boiling in such a fashion as to convey the impression of its being in a very liquid state. These mud-pools are separated from one another by comparatively solid ground, and in some cases, especially towards the eastern side of the fissure, what appear to be small pools of water with sedgy margins could even be distinguished; but the difficulty of estimating distances and depths through the steam-clouds rendered the observations made very uncertain.

"The largest of these mud geysers appeared to be that rising from the position formerly occupied by the Pink Terrace, but the most interesting is one a mile further south, which, unlike the others, does not spring from the bottom, but from the comparatively high ground on the west side of the fissure, and, owing to the obliquity with which the fragments are thrown out, is gradually building up a conical mound, which already has attained an altitude of several hundred feet (Mount Haszard, on plan). At the southern extremity the fissure is bounded by a bold semicircular extremity, from the base of which powerful steam jets are escaping; but there was no evidence that it was prolonged by a crack or fissure, or fault, or other displacement of ground, nor was there any evidence that the fissure had been produced by any inequality of the movement of the ground bounding it, but rather that it was caused simply by the removal of material which formerly occupied its space. Its direction, as far as could be ascertained, is N. 50° E., which is the general line of direction that would connect all the more active geysers between Tongariro and White Island.

"IV. *Matter ejected during the Eruption.*—The quantity of matter which was ejected during the different phases of the eruption was very large. In the first place, stone fragments were scattered from the earlier eruptions of Tarawera over an area of country extending to the eastward as far as Te Teko, and even, some say, to Fort Galatea; while in the opposite direction they are not reported to have fallen at any place farther west than Wairoa, a distance of six miles. None of the fragments which I collected are other than portions of rocks of the district, nor do they present in the slightest degree the character of volcanic bombs or lapilli formed from lava or rock material in a state of fusion. Yet there can be no doubt, if we can accept the evidence of the eye-witnesses, that these rock-fragments must have, in some cases, reached the ground in a partially incandescent state. Next followed the great ejection of pumice-sand, which forms enormous deposits in two localities: the one is on the eastern slope of Tarawera Mountain, already described, the nature and origin of which I had no opportunity of ascertaining; the other deposit of this nature is chiefly on the western side of Rotomahana fissure, and was no doubt ejected at the commencement of the second phase of the eruption. Over a district of twenty-four square miles south of Tarawera Lake, and on an almost equal area to the north and east of the lake, the whole surface of the country has been covered with this pumice-stone so thickly as to obliterate in a great measure the natural features, partly filling the gullies and enveloping all the hills as if with a deep mantle of snow, so that not a trace of vegetation can be seen, from the highest peaks, such as Te Hape-o-Toroa, which is 2300 feet above the sea, down to the level of the lake. The thickness of this deposit could not be ascertained at the time of my visit, as no slips had occurred in it and no sections were to be seen. It consisted of fine-grained and gritty pumice-sand, slightly crusted on the surface by the action of the rain, which also caused it to assume a slightly greyish tinge; but underneath it was a pure white, and at a depth of 12 inches to 18 inches from the surface had still a high temperature on the sixth day after the eruption.

"Lying on the surface of this deposit, especially on the slopes directed towards the fissure, fragments of considerable size of various kinds of rocks were scattered about, and among these were masses evidently derived from the sinter of the terraces, and, from the manner in which these fragments appeared to occur in quantities where the finer dust had been blown from the surface, it is probable that the lower layer of the deposit will prove to be composed of coarser material than the upper. The boundary-line of this dazzling white deposit is very distinctly marked. It can be well seen where it passes over Kakaramea Mountain, dividing it, as it were, into two portions, one white and the other green. While traversing it we experienced a great downpour of rain, which formed the powdery material of the surface into little pellets; but it did not appear to be very absorbent, or to show any tendency to work up into an adhesive material. This is very different from what may be termed "the grey deposit" which is next to be mentioned, and which covers the country, from about two miles south of Wairoa, in a northerly direction towards the Bay of Plenty, as far as the Te Puke Settlement. This is the mud-forming deposit, and wherever it appears to have descended in a thoroughly pasty condition it coated the vegetation so heavily as to break limbs off lofty trees and to crush the smaller scrub flat simply by its weight. The sand, as already stated, appears to have fallen hot, so hot, indeed, as to set fire to the trees, the stumps of which were seen burning in many places; but there is nothing to lead us to suppose that this grey mud when it fell was even warm.

"It has been suggested by some that this moist deposit was mud thrown out from the bottom of Rotomahana Lake; but it is difficult to conceive how, in that case, it should have overleapt a strip of country four or five miles wide, where there is nothing but dry sand, before it reached Wairoa; and I think that a more likely source for its origin is to be found in the sudden condensation of the front edge of the great vapour-and-dust cloud when it suddenly met the violent cold south-west gale which averted it from Rotorua and directed it towards the sea-coast, where it spread over the sky and caused the darkness that was experienced at Tauranga and all over the country to the eastward. The great volume of this dust-cloud was directed towards the East Cape, dropping over the country in that direction a comparatively heavy deposit of brownish-black dust, so coarse as almost to be sand; while on its northern edge, as far east as Tauranga, the dust is of a light grey colour, and excessively fine in grain. A collection of all these different deposits has been obtained, and will be reported on as soon as the chemical analysis is complete. The impact of the moist deposit when it fell must have been very great, from the effects which it produced at Wairoa, where it appears to have attained its maximum thickness of about 12 inches in open level places free from any influence that would cause it to drift; on the flat spur above the bridge at the outlet of Rotokakahi its depth was found to be 9 inches, and in the Tikitapu Bush 4 inches; and from that point it gradually decreased towards the north. The action of rain upon this mud rapidly converts it into a semi-fluid condition, in which state it slides off the hill-slopes and fills the low grounds and watercourses; and where it has been thickly deposited it will thus be a constant source of danger for some time to come, but where only an inch or so in thickness it will, I believe, rapidly disappear, and, excepting that it may for a time deteriorate the pasture and destroy the existing vegetation, it will in the long run be an advantageous addition to the light pumice soils upon which it has been deposited, owing to its slightly absorbent properties. As for the light deposit of dust, which fell in a dry state, there is very little doubt that it will be all washed off into the soil with the first heavy rains that come. The distance to which this fine dust was carried was very great, exceeding at least 120 miles from the focus, in a direction between north and east; and the time it remained suspended in the atmosphere was at least eighty-four hours, as we passed through it in the *Hinemoa* when crossing the Bay of Plenty on the Saturday afternoon, as a peculiar yellowish fog, charged with pungent acid vapour and dust; and on the following afternoon we recognised the same fog-cloud still suspended in the atmosphere towards the north-east.

"V. *The Evolution of Steam.*—The enormous volume of steam rising from the site of Rotomahana Lake gives rise to a pillar of cloud that is visible in all directions over the country, having a diameter of about an eighth of a mile, and rising to a height of not less than 12,000 feet. Its effect is most impressive, especially in the morning and evening, when it is lighted up with gorgeous tints by the slanting rays of the sun when it is below the horizon, and all the surrounding landscape is in twilight. Although this steam-cloud receives rapid additions in its lower part from successive explosions, these do not generate any rapid movement through the mass of the cloud, so that, if viewed from a distance, it appears to be almost solid and immovable, except the changes that are gradually effected upon its lower portion by the movements of the atmosphere.

"VI. *The Propagation of the Earthquake Tremors.*—Earthquakes are the usual results of the violent concussions attendant upon violent outburst, and they afford the only clue which we can possibly have as to the depth below the surface of the earth at which the volcanic energy has been exerted. Thus, if the earthquakes are felt with only slightly-decreased violence to great distances from the focus of disturbance, it would indicate that the disturbance is a deep-seated one. On the other hand, if the earthquakes, although extremely violent close to the focus, are only felt at a moderate distance, the conclusion to be drawn is that the forces at work are only superficial. All reports agree that at the Wairoa, about four miles distant, which is the nearest point to the eruption from which any persons have survived, the shocks of earthquake during the first phase were violent and continuous; whereas at Rotorua, twelve miles distant, they were comparatively slight. The great earthquake at the commencement of the second phase appears to have been felt with considerable violence at Rotorua, and distinctly arrested attention for a distance of at least from sixty to seventy miles, but does not appear to have done any damage.

"During our visit the earthquake shocks in the vicinity of Rotomahana were still frequent and violent, but at Rotorua they were only experienced as gentle undulations; and I ascertained that they proceeded from the effects of the explosion from the Rotomahana fissure, and that the eruptions from the summit of Tarawera, which were clearly visible from Rotorua, did not produce the slightest apparent tremor at that distance. A few insignificant earthquake-rents were seen crossing the flats south of Kaitiriria, but only where there was a drop or unsupported bank.

"VII. *The Sounds.*—The sounds produced during the eruption must have been, from all accounts, appalling to those within a moderate distance. The crackling thunder produced by the electrical discharges, the terrific roaring of the high-pressure steam escaping through the volcanic vents, were combined with terrifying effects. Much has been said about noises heard at Auckland, Wanganui, and other places. From the times mentioned, these appear to have been due to the reverberating reports accompanying the Tarawera outbreaks. Some of these noises may have been propagated through the atmosphere, and reflected to the earth from the under surface of the stratiform cloud-sheets that were widely spread in various directions over the colony on that morning. Others, again, may have been propagated through the earth.

But I have been informed that at the whaling settlement of Tawaite, on the east entrance of Tory Channel, from six p.m. up to about eight p.m. on the evening of the 9th (the night preceding the eruption), loud booming reports were heard as through the earth. As these reports were previous to any symptom of the loud disturbances at Tarawera, this suggests that they may have resulted from a slight movement along the great fault-lines that traverse the North and South Islands in a north-easterly direction; and, in this case, the immediate cause of the Tarawera outburst may be found in a local fracture resulting from such movement.

"VIII. *Premonitory Symptoms.*—The only premonitory symptoms of the coming outburst which have been described were an oscillation in the level of Tarawera and Rotorua Lakes, and the occurrence of earthquakes for some months past in that district, where, as a rule, earthquakes are rarely felt. But neither of these are very characteristic incidents, nor would it be safe on future occasions to base any expectation of an eruption on such phenomena alone. The increased activity of the geysers and hot springs during the past season has also been advanced as having been a symptom of an approaching outbreak; but those who were most familiar with the district will agree that their variation was no greater than is usual under the influence of rapid changes of wind and atmospheric pressure. The reports of sympathetic outbreaks in other places along the line of volcanic energy from White Island to Ruapehu appear to be quite unfounded. The outburst has shown conclusively that the springs at Rotorua and Rotomahana are quite independent of each other, and of those at other places, thus confirming the observations made by Von Hochstetter long ago, that all the various points at which thermal springs occur are situated round the margins of lakes formed by subsidence of circular areas, and are not connected by an underground system of gravitational drainage.

"IX. *Conclusion.*—From the foregoing sketch of the character of the eruption I think there can be little question that it is a purely hydro-thermal phenomenon, but on a gigantic scale; that it is quite local and not of deep-seated origin, and that all danger is past for the present, so far as one can venture to form an opinion on such a subject. The extra activity of the *puias* which has been observed is no doubt owing to the heavy rains that, on the 9th, set in after the longest period of drought which has been experienced in that district for many years, and probably the frequent earthquakes which have of late agitated the ground have contributed to this activity by stirring up the sources of the water-supply, and facilitating the access of drainage-waters to the sources of the heat. But beyond what may be accounted for in this manner I believe there is no increased disturbance at Rotorua, Wairakei, Taupo, and other places. The quiescent condition of Tongariro and Ngaurahoe was plainly shown by the manner in which we observed it to be enveloped in snow. As a rule, on the scoria cone of Ngaurahoe, snow rarely lies, excepting in a few of the gullies, but melts almost as rapidly as it falls. On the morning of the 17th, however, the cone of Ngaurahoe was covered with a great mantle of snow; while the *puias* on Tongariro showed less than their usual amount of steam escaping. The only fresh activity which may be reasonably expected is that which I anticipate when sufficient rain has fallen to cause the overflow of Okaro Lake into the south end of the great fissure, as its former drainage outlet to the Rotomahana Lake appears to me to be completely filled up. If this should occur, and a fresh explosion takes place in consequence, it will be comparatively moderate in its effects, as, unlike Rotomahana, the soft, incoherent pumice deposits between the fissure and Okaro Lake are not sealed down by an enormous weight of siliceous sinter.

"For some time to come great variations must be expected in the activity of the newly-formed *puias* according to the manner in which changes occur in the atmospheric pressure; but, unless it can be shown that any local change in the barometer is experienced which is not shared by the surrounding district, the barometer affords no indication as to whether an eruption is or is not imminent. One of the most unfortunate results of the eruption, in addition to the disastrous loss of life and the destruction of the country, is the disturbance of the sense of security which has grown up amongst those residing at the Hot Springs; and I believe that many persons are so thoroughly shaken by the horrors experienced on the morning of the 10th that they will not recover their equanimity until they have been for some time resident away from the sounds, smells, and shocks that characterise the district. "JAMES HECTOR"

IN QUEST OF THE ORIGIN OF AN EPIDEMIC

IN our issue of the 8th ult. (vol. xxxiv. p. 213) we dwelt on certain general aspects of the reports lately laid before the President of the Local Government Board by the Medical Officer of the Department on milk-scarlatina, but these documents deserve more detailed consideration, for they show us our modern organisation for combating death and disease, by prevention, at its best. They show us, too, the men to whom the task of guarding public health is primarily committed at their best—patient, watchful, wary, tenacious of the thread of their investigation, eliminating this or that doubtful element, until finally they have tracked their quarry to its lair. In reading Mr. Power's report, we have been constantly reminded of that famous description of the contest between the man and the gun in Hugo's "Toilers of the Sea." Here the fight was man against disease, and the former has succeeded in his task. We shall endeavour in this article to show how Mr. Power, of the Local Government Board, succeeded in tracing, step by step, an epidemic of scarlatina to its source.

On December 18, 1885, Mr. Winter Blyth, the Medical Officer of Health of St. Marylebone, reported to the Board an extensive outbreak of scarlatina in his district. This he believed to be associated with the distribution of milk from a certain retailer in South Marylebone, who obtained his supplies from two farms, but the occurrence of the scarlatina appeared to be coincident with the milk-distribution from a certain farm at Hendon. Mr. Blyth had himself visited this farm, and, with the assistance of Dr. Cameron, the Hendon Medical Officer of Health, had carefully examined it, but was quite unable to discover in its sanitary circumstances or in the health of those employed about it any sort of clue to the cause of the infection of the milk. Accordingly he went with his story to the Local Government Board. It will be seen that Mr. Blyth had done his work exceedingly well: in one of the most crowded districts of London he had succeeded in tracing the scarlatina to a farm at Hendon; that is, he had made out a strong *primâ facie* reason for suspecting this farm; he had put a clue into Mr. Power's hands which he had not been able to follow any further himself. The first question for Mr. Power to answer was whether the Hendon farm was at fault or not. When this was answered it would be time enough to pursue the inquiry more minutely: it would be loss of time to try to dig out the fox unless it was first ascertained that he was in that particular earth. With this object, then, Mr. Power traced the milk from the Hendon farm to other milk-retailers in St. John's Wood, St. Pancras, Hampstead, and Hendon itself. From each of these, except St. John's Wood, the same story came. Until the end of November or beginning of December the district had for some months been exceptionally free from scarlatina, but about