

shaped support of cast zinc, L L, which is screwed to the laboratory wall like a bracket.

It will be seen that Dr. Edelmann has discarded the Leyden jar, replenisher, and gauge, which play so important a part in Sir W. Thomson's electrometers. Instead of these a Zamboni pile, or a battery of 200 small well insulated voltaic elements, is used. These are made of test-tubes filled with common water, and having small zinc-copper pairs placed from cell to cell. It is difficult to believe that either of these dispositions is an improvement on the replenisher-jar-gauge arrangement, though either may be somewhat cheaper. Nor is it likely that the presence of the ebonite rings R and S will add, in the

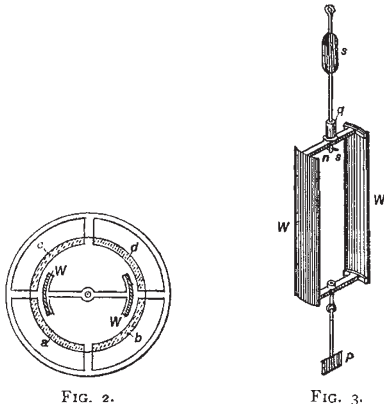


FIG. 2.

FIG. 3.

long run, to the satisfactory working of the instrument; for, as is well known, this substance when exposed to light decomposes at the surface, and becomes covered with a conducting-film of acid. The insulation of the quadrants ought not to be risked by such a doubtful device. It ought to be mentioned that a cylindrical arrangement of quadrants had been previously employed by Silow in an instrument for investigating the dielectric capacity of liquids; but to Dr. Edelmann is due the credit of having applied this arrangement for the construction of these electrometers, which in consequence of their many good points are becoming so popular for laboratory work both in Germany and elsewhere.

#### GLEANINGS FROM THE REPORTS CONCERNING THE ERUPTION OF KRAKATOA

I DO not propose to give here an abstract of all the reports which I have gathered, but I only wish to state some important data which might be useful to those who wish to become acquainted with the full particulars concerning the eruption. Therefore I have mentioned the authorities from which I have taken the following statements, in order that the reader who wishes for more circumstantial reports may find them easily.

I regret to say that I have not been able to find any reports from Tjiringin and the lighthouse-keepers of Java's First Point and Vlakke Hoek. In the beginning of October an engineer of the mine-service was sent to Krakatoa to examine the island, and he is expected now to bring in a scientific report about the eruption; it is to be hoped he has insisted that everything referring to the catastrophe should be circumstantially recorded.

1. *Data referring to the time anterior to the Eruption.*—In a report which was published in the *Java Courant* (the paper of the Dutch Government), which was brought from Batavia by the mail of August 25, it was said: "There are now two craters on Krakatoa, 3 km. distant from each other, which are continually working. The western crater is at the foot of Mount Perbuatan (working since May 20); the eastern crater working since a more recent

date (which is unknown to me) at the foot of Mount Dannan. The outlines of the top of Mount Perbuatan are changed; the outlines of the beach are also altered by some increase of land along the shore. The trees which covered the island are burnt for the greater part."

As to what occurred before and during the eruption of August 26 and 27 I particularly took the data:—

(1) From the report of the *Berbice*, Capt. Logan, from New York (*Nieuws van den Dag*, October 11): August 26 at 2 p.m. she was off Vlakke Hoek, 20 miles to the south; she got sight of the light of Java's First Point August 28 at 12 p.m. Since August 26 at 4 p.m. she had only little sail; 28, at 4 a.m., maintopsail was set; afterwards at noon she set full sail and made for First Point. Therefore she was during the eruption near a line which joins Java Head and the point where she was August 26 at 2 p.m.

(2) From the report of the *Charles Bal* (*NATURE*, Dec. 6, p. 140): She passed Prince's Island August 26, at 9 a.m.; Krakatoa seen at 4.15 p.m., north half east, 10 miles distant. At 11 p.m. the island became more visible, west-north-west, 11 miles distant; August 27 at 6 a.m. she set sail, passed lighthouse Fourth Point at 8 o'clock, Anjer at 8.30; passed Button Island at 10.15.

(3) From the report of eye-witnesses, who were at Anjer during the catastrophe (*Nieuws van den Dag*, October 11 and 14).

(4) From a report written by a passenger (an engineer) of the *Gouverneur Loudon* (Dutch Indian steamer, 761 reg. tons, 190 h.p.) (*Nieuw. Rotterdam. Courant*, October 23, by Mr. van Sandick): She was off Anjer August 26 at 3 p.m.; went to Telok Betong, where she arrived at 7 p.m.; remained there till next morning at 7 o'clock. After a wave had destroyed Telok Betong she made for Anjer, but before she had left the bay darkness came on, and she was compelled to lie there till August 28 in the morning.

(5) From the report of eye-witnesses at Telok Betong (*Nieuws van den Dag*, November 3 and 13).

Moreover, I took a few particulars from the reports of Katimbang (*Nieuws van den Dag*, October 16) (Lampoung, at the foot of the Radjah Bassa), Binuangan (*Nieuw. Rotterdam. Courant*, October 23) (at the bottom of the Semangka Bay), and Pulu Merak (*Nieuws van den Dag*, October 10).

Though *e.g.* on the Island Bali strong detonations were heard in the morning of August 26, the reports of Telok Betong and Anjer say: Fine weather, no extraordinary detonations in the afternoon. *Berbice* reports: Sky dark at 2 o'clock, threatening at 4 o'clock; at 6 p.m. thunder and lightning. On board the *Charles Bal* at 4.15 an eruption at the east of Krakatoa was observed; the masses which were driven forth to the east had the appearance of a furious squall. Anjer reported: At 6 o'clock quite dark; at Telok Betong at 6 p.m. slight rain of ashes; at the same time *Berbice* experienced ashes pouring down at once; it was quite dark. Fall of ashes and darkness continued the whole evening. About this time the commotion of the sea began also. At Anjer, between 6 and 7 p.m., several vessels were carried by the wave to and fro in the harbour (canal), but the sea did not flow over. From Merak is reported, August 26, at 7 p.m. or 7.30 p.m.: Heavy detonations, violent shocks (but no earthquake). Waves swept away the Chinese camp; caused much damage. In the night (I could not find out at what o'clock) fiery phenomena were seen in the direction of Krakatoa, shocks of earthquake, waves. The Controleur, who was at Katimbang, related: "August 26, 7 p.m., several prows thrown on the beach, waves, but the sea did not flow over, nor did the waves grow higher."

The *Loudon* came to anchor off Telok Betong at 7 p.m. Rough sea, boats could not communicate. They observed that there was something wrong, but could not make out what it was. The Dutch bark *Marie*, which was there

also (there are two vessels of the same name, *Marie* and *Maria*, in the list, the one, *Marie*, of 570, the other, *Maria*, of 790 tons) reported: At 7.30 currents observed in different directions, some small vessels lost their anchors, ten persons saved from being drowned. From Telok Betong is reported: By 6.30 sea quite calm, level of the sea 1 metre lower than pier, a moment afterwards 1 metre above it; people who were at the end of the pier, about 1000 metres distant from the shore, had to walk back through the water, which was done without accidents. Meanwhile the *Charles Bal* was in a fearful situation since 5 o'clock. She reports:—"At 5 p.m. sky darkening, detonations stronger, pumice-stones pouring down, rather big pieces, had to cover skylights. At 6 p.m. big pieces ceased, small pieces, ashes, &c., continued. Terrible night. After 7 p.m., at Anjer, heavy detonations were heard, the ground was groaning, thunderstorm; by 9.30 calm, slight rain of ashes. After this the sea was very calm. After midnight some waves were observed, which were not violent. Lloyd's agent at Batavia wrote under date of October 16 (*Scotsman*, November 24):—"But we know now that the village of Sirah, six miles below Anjer, was partially submerged at 1 o'clock on Sunday night, August 26. This I had from the head man himself, who at the time reported it at once. . . . At Anjer, however, nothing was felt and no alarm was experienced." At Katimbang a noise was heard of a far-off wave at 10 o'clock, and the Europeans and natives went to a higher place. During the night the waves were heard causing an awful devastation. At Telok Betong, by 10 o'clock, several vessels were thrown on the beach (among which the steamer *Berouw*, draft 1'75 m., 4 guns, 30 h.p., 4 Europeans, 24 natives), houses swept away, people drowned, &c.; towards midnight calm.

From this it seems to me that no extraordinary detonations were heard nor any phenomena seen which could have startled the inhabitants, who, however, had been accustomed for three months to the noise of Krakatoa.

Meanwhile the outburst continued. The *Berbice* reported:—"At midnight ashes increased, pieces of pumice-stones, thunder and lightning increased, fireballs fell on deck and were scattered about, fearful roaring, copper at the helm got hot; helmsman, captain, and several sailors were struck by electric discharges; sail over the hatches to prevent fire, helm tied, crew sent below, captain and master kept guard; 27th, at 2 a.m., all hands to shovel ashes into the sea (were about 3 feet thick lying on deck). In a still worse situation was the *Charles Bal*. Lightning continued; saw a light at 11 p.m., supposed it to be the light of the Fourth Point (Anjer lighthouse); lay by; Krakatoa visible in west-north-west, 11 miles distant; wind strong south-west, chains of fire appearing to descend and ascend between the sky and the island, while on the south-west end there seemed to be a continued roll of balls of white fire; the wind, though strong, was hot and choking, sulphurous, with a smell as of burning cinders, some of the pieces falling on us being like iron cinders, and the lead from a bottom of 30 fathoms came up quite warm. From midnight to 4 a.m. (27th) wind strong, but very unsteady between south-south-west and west-south-west, impenetrable darkness continuing, the roaring of Krakatoa less continuous, but more explosive in sound, the sky one second intense blackness, and the next a blaze of fire; masthead and yardarms studded with corposants, and a peculiarly pinkish flame coming from the clouds, which seemed to touch the mastheads and yardarms."

On the morning of August 27, by 6 o'clock, as is reported from Binuangan (Semangka Bay), the sunken cliffs were visible; a little while afterwards a wave came and returned, but another followed, which did much damage; soon (?) after this it became quite dark, mud and ashes poured down; several waves followed till late in the evening; darkness continued till next morning.

From Anjer is reported that it was about 6 o'clock when the first wave came. One of the persons who were saved said: "I went out about 5.15. After having talked with several persons, I saw the wave, still far off, rapidly making way towards us. I ran away, was followed by the wave, fell down quite exhausted, but happily on a hill, where the water could not reach me. Before my eyes all the houses along the beach were destroyed." Another person reported:—"I was early at the beach (early, after Indian habit, might be at 5 o'clock). When I returned home I heard a cry, 'The flood comes.' On looking round I saw a high wave which I could not escape; I was lifted from the ground, but caught hold of a tree. Then I perceived several waves, which followed the first; the place where Anjer had been before was covered by a turbulent sea, from which some trees and roofs of houses were still peeping out. After the wave had flowed off, I left the tree, and found myself in the midst of the devastation. The Chinese camp was not yet destroyed." A third person, who was still in bed at 6 o'clock, was lifted up by the wave and carried to a hill. All agree that after 9 a.m. it became dark, and a pouring down of mud and ashes commenced (darkness till next morning), &c. From Merak it is reported that in the morning all European officers were in their houses; when the first wave came they were not afraid, and would not yet go to the hills. The *Berbice* reported: "Till 8 o'clock it was, as before, quite dark, afterwards worse." The *Charles Bal*: "August 27, 6 a.m., being able to make out the Java shore, set sail. Passing Fourth Point Lighthouse at 8, hoisted our signal letters, but got no answer. Passed Anjer at 8.30, name still hoisted, close enough in to make out the houses, but could see no movement of any kind; in fact through the whole straits we have not seen a single moving thing of any kind on sea or land."

I must confess I am here at a loss. It is possible that the *Charles Bal* passed Anjer after the first wave had annihilated most of the living beings and before the following waves had finished the destruction of buildings, though it would be strange if at the lighthouse all the people had been killed before the building was destroyed. Moreover, it seems strange to me that the captain should not have seen the devastation nor remarked the tidal waves. When they came on, the ship was very near them, and even if we suppose that the waves had been shot like a projectile from Krakatoa on to Anjer, it would be astonishing that such a considerable mass of water should not at all have been perceived, or not described if it had been. We learn from Anjer (and from Telok Betong) that it was seen from the beach like a black wall, and it must have had a considerable height, for it covered all the houses and trees which were near the beach; now an ordinary house might at least be ten or twelve metres high, and the shaft of a coconut tree has also a considerable length. *Loudon* reports: August 27, in the morning fine weather, at 7 a.m. an immense wave came on; the *Loudon*, under steam, turned her head to it, was lifted up, but kept well; now the wave rushed on to the beach, and before the eyes of the passengers and crew of the *Loudon*, houses disappeared; the *Berouw* (which had been thrown on the beach on the evening of the 26th) was lifted up and carried a few kilometres into the land. The place where Telok Betong had been before was changed into a violent sea (except the buildings on the hills). Three other waves followed at short intervals. Since it was supposed that the cable had been destroyed, the steamer intended to go to Anjer to report the catastrophe. Before she could get out of the Lampong Bay it darkened. The mate of the *Marie* reports: August 27, in the morning the sea was calmer, but queer weather, sky threatening, prepared the third anchor. At once we saw an immense wave at the horizon making rapidly its way on to us; we spiked up the hatches, and after having done it the first wave struck



the vessel, and threw it on the beach; after the wave had flowed off, the *Marie* was literally on dry sand; one could have walked around the vessel. Part of the crew left the ship. From the barracks at Telok Betong, on the Talang Hill, about twenty-five metres above the level of the sea, an eye-witness wrote: At 6.20 I went to Kampong (village) Kankong, about 1400 metres distant from the barracks, to see the destruction which the wave had caused the night before. After I was there I saw a wave rushing on to us; we hastened to the hills, the villagers following us. When I had reached the barracks, I saw Kampong Kankong had disappeared, and so had the other villages near the beach. Before the darkness began the water rose. At Katimbang they perceived in the morning what damage had been done—by little and little it became dark.

At 10 o'clock it was so dark aboard the *Loudon* that not even outlines of the ship or persons were visible; she stopped for eighteen hours. Rain of mud covered the deck 0.50 metre thick. Needle of the compass violently agitated; barometer extremely high; breathing difficult through damp; some people got unwell and sleepy. After the darkness began the sea became violent, the wind increased; at last it was a hurricane. Then several heavy seas came, some of which came across and almost capsized the vessel. The flash of lightning struck the *Loudon* seven times, went along the conductor, but, when still above the deck, sprang over into the sea. This was accompanied by a dreadful crackling. At such moments the vessel and the surroundings were brightly lighted; it was a fearful sight, everything being covered with a grayish mud. During all this time the *Loudon* was under steam, steaming slowly at two anchors. St. Elmo's fires at the masts and yards. August 28, at 4 a.m., feeble moonlight (moon's rise at Batavia, August 28, at 2.15 a.m.) at the horizon. After the sun had come up she tried to leave the bay. It seems worth attention that during all these fearful hours no detonations were heard aboard the *Loudon* (this is expressly mentioned in the report).

At Merak an immense wave came by 9 o'clock from the west and rushed to the east. The European who alone escaped went to the hills, while darkness surrounded him. The mate of the *Marie* writes:—By 10 a.m. (August 27) three heavy seas came after each other; quite dark; at once a fearful detonation. Sky in fire, damp. By 3 p.m. three seas again, after this the sea quite calm. Dark till next morning, then (28th) *Marie* was found afloat again. From the barracks (Telok Betong) it is reported:—By 9.30 a.m. a downpour of ashes, later stones and mud; about half an hour afterwards the level of the water was only 1 or 2 metres below the top of the hill. Now it was taken into consideration to give up the barracks and retire to a higher point. In the night the rain of mud ceased by little and little, the sky cleared up, stars appeared. When, at Katimbang, it had become quite dark, fearful detonations, like thunder and reports of guns, were heard. By 11.30 pouring down of stones began (the biggest as large as a fist). Half an hour after, 12 o'clock, it became quite dark; heavy rain of ashes soon afterwards, hot ashes (during a quarter of an hour), then cold ashes; darkness continued (it is not said when it dawned). From the *Charles Bal* is reported: "At 11.15 there was a dreadful explosion in the direction of Krakatoa, now over thirty miles distant. We saw a wave rush right on to the Button Island, apparently sweeping right over the south part, and rising half way up to the north and east sides. This we saw repeated twice, but the helmsman says he saw it once before. The same wave seemed also to run right on to the Java shore. At the same time the sky rapidly covered in, the wind strong from south-west by south; by 11.30 we were inclosed in a darkness that might almost be felt, and at the same time commenced a downpour of mud and sand,

&c., which put out the side lights. At noon the darkness was so intense that we had to grope our way about the decks, and although speaking to each other on the poop, yet could not see each other. This horrible state and downpour continued till 1.30, the roarings of the volcano and lightnings being something fearful. By 2 p.m. we could see some of the yards aloft, and the fall of mud ceased. (Here the explosion and the beginning of the darkness are reported about two hours later than from Lampong Bay or from Anjer, and still more astonishing is it that nothing is said about the wave which annihilated Merak). At 5 p.m. the sky cleared up in the north-east, but till midnight sky dark, now and then ashes falling. Though the vessel was sixty-five to seventy miles distant from Krakatoa, the roaring of the volcano was still audible." From the *Berbice* is reported: At 11 a.m. (27th) strong wind south-east; at 3 p.m. high wave (about 20 feet high) struck the vessel so hard that the chronometers were arrested. Thunder, &c., continued, and the hands of the barometers were violently agitated between 28 and 30 inches. At 6 p.m. no change, sea relatively calm, lightning allowed us to see the vessel surrounded by a sea of pumice-stone; at midnight, weather calm, lightning more remote. August 28, at 4 a.m., calm, maintopsail set. Darkness continued. At 8 a.m. they saw daylight again. Weather calm and bright. Ship covered with ashes about 8 inches thick. During the eruption about 40 tons of ashes were thrown overboard; more sail set; had full sail at 12 o'clock, and went straight on to Java Head. Floating pumice-stone diminished the speed of the vessel. At midnight light of First Point was seen; when they passed Prince's Island they saw banks of pumice-stone 18 to 24 inches thick. In the afternoon they passed between Krakatoa and the Java shore. As far as they could see the island was by two gaps divided into three parts. The sea was covered with pumice-stones and floating corpses.

I continue the report of the *Loudon*:—Ashes and pumice-stone were still falling, but only slightly; the vessel was near the shore; it was a dreadful sight, trees buried under ashes and mud, the sea covered with pumice-stone and driftwood. Near Puluiga the entrance of the bay was obstructed by islands of pumice-stone, like cliffs; they formed a bridge between Puluiga, Sebu, and the mainland. Since the channel of Lagundi Straits seemed comparatively open, the *Loudon* made for it, but she met there with an island of pumice-stone, about 3 m. thick; she went ahead against it, the pumice-stone gave way, and though there were some difficulties at the pumps, the *Loudon* got free; now it was resolved to go to Anjer, the vessel came to the Sunda Straits, west (in the report is said east, which seems a slip to me), then south of Krakatoa; when this island was at larboard (I think it means when the *Loudon* went to the north, passing between Krakatoa and the Java shore, for after having left the Lagundi Straits, she continually had Krakatoa on the larboard) it was seen that the greater part of the island had disappeared; there was a steep crater-wall, the peak as it were cut into two. In the wall large cracks filled with smoke were remarked. In the sea between Krakatoa and Sibessie several volcanic reefs were seen, there, as it seemed, volcanic powers were still at work. At eight different places columns arose, which, after having originated in a dark point, grew larger, got as it were a white bordering, arose to a considerable height, and gave way to another column. It could not be made out whether these phenomena were waterspouts or volcanic eruptions.

It is known that the detonations were heard all over the Dutch colonies and further; I only beg to record that at Acheen, 5½° N. lat., they were so distinctly heard that military forces were sent out, since it was supposed that a fort had been attacked. It may be interesting to see a report from Padang Panjang, which runs as follows: August 27, 8.30 a.m., at once a heavy explosion, a single

thick cloud of smoke arose (from Mount Merapi  $0^{\circ} 20' S$ . lat.,  $100^{\circ} 28' E$ . long. Greenwich) drove directly away; now smoke arose from a point at some distance from the crater, uncertain whether it originated in ejected matters, or whether there were fumaroles. After five minutes the same phenomena were observed; afterwards it was perfectly quiet. At 10.50 a.m. hollow groaning; another column of smoke arose; ashes falling eastward; two columns of smoke. During all this time a fearful noise was heard from afar, which became stronger after 11 a.m.

Dr. B. Hagen wrote to the editor of the *Ausland* (*Ausland*, No. 46) from Tandjong Morawa (Deli, Sumatra, almost 1000 km. distant from Krakatoa): In the afternoon (27th) thick white clouds were seen coming from the volcano Sipaia (or Guming Balerang), more than 30 km. distant to south-west.

From Menggala (130 km. from Telok Betong to the north-west) is reported: Slight concussion of the air, rain of ashes, darkness. From Sukadana (105 km. from Telok Betong to the north-east) is reported: Much damage done by falling ashes and stones.

During the eruption there were still two vessels near the Sunda Straits the reports of which are to be mentioned. The *Annesley* (*Times*, weekly edition, Oct. 12), Capt. Strachan, from Singapore, August 27, for Mauritius: At 10 a.m. it was so dark that they had to light all the lights. Barometer rising and falling  $\frac{1}{8}$  inch to 1 inch in the minute. Ashes and pumice-stones falling. Towards the night ashes stopped, but it was as black as night. August 28, they passed the Sunda Straits, and heard from the lighthouse-keeper (Java's First Point) that he had had fearful weather. Had some of the ashes as far as 100 miles clear of Java Head.

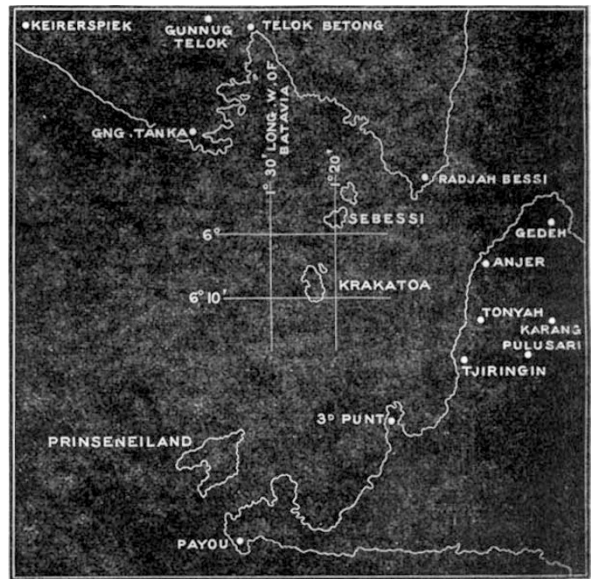
The hopper barge *Tegal* made from Batavia for Merak, August 27, early in the morning. On the way they met with ashes and stones pouring down; it became quite dark, sea rough; came to anchor by 12 o'clock; dreadful weather; she dragged her anchor. Towards 3 o'clock the sky cleared up, then went on till 5 p.m. In the night they saw a bright light in the south and west, many flashes of lightning, and balls of fire; several sea-quakes; at once sea like glass. In the morning (August 28), when it dawned, the *Tegal* was off St. Nicholas Point; now she entered the straits; they saw the devastation. At Dwars-in-den-Weg the sea had still deepened the deep places which were there before; Saleier and Tempora had disappeared; the height of the waves at Merak was estimated from 30 m. to 40 m. by the chief of the works at Merak (*Nieuws van den Dag*, October 10).

The *Prins Hendrik*, a Dutch man-of-war (2000 tons, 400 h.p., 5.5 m. draft, 8 guns, 229 Europeans, 53 natives) was sent to the Sunda Straits for the safety of the vessels arriving there (*Nieuws van den Dag*, November 17). She first went to Vlakte Hoek, but could not communicate on account of the pumice-stone; another vessel succeeded in communicating (September 3), and found of the men of the lighthouse (5 Europeans, 14 coolies) 10 natives dead, 3 Europeans and 4 natives wounded. The base of the lighthouse is 2.5 m. above the level of the sea; the first (iron) floor was broken, the lodgings near the lighthouse swept away. The *Hendrik* observed that the north part of Krakatoa had disappeared; from the part which remained, from Verlaten and Lang Island, and the new ones (Calmeyer and Seers), smoke continually arose; now and then, by night, a flame was seen. September 16, the *Hendrik* tried to enter Semangka Bay. They found a place where the sea was not covered with pumice-stone, but landing was impossible, the breakers being too strong; next day a boat was sent again, which was beset in the floating masses. The pumice-stone around the *Hendrik* was now 5 feet thick, and one could stand on it. The boat had at last to be given up, the crew (being one lieutenant, Dutch Navy, two boatswains, fourteen sailors) went on shore. The *Hendrik* tried to leave the bay, but

could hardly turn round; a condenser exploded, and they had to come to anchor. As far as they could see, the sea was covered with pumice-stone. After thirty hours the engine had been repaired and cleared, and after much trouble the steamer got out of the bay.

Though the reports which I have mentioned are far from being complete (I shall try to complete them), I think they are sufficient to draw some conclusions:—

1. As to the height of the wave, we have seen that the first waves at Anjer were more than 10 metres high (August 27, 6 a.m.). At Merak the height of the most destructive wave (by 9 o'clock) is estimated at 30-40 metres by the engineer himself, and Mr. McColl (the *Scotsman*, November 24) estimated it to be 135 feet (about 41 metres). At Telok Betong (Talang hills) it was about 23 or 24 metres, but here it was not properly speaking a wave, but it seems that the water in Lampong Bay was dammed up as it were. I suppose that the bay by the first waves was filled, and the mass of water broke here the force of the explosion, and the wave by which the latter was followed was turned to the east (from Merak the wave came from west). In general I do not



suppose that we may speak about "waves" in the ordinary sense. Besides the previous commotions, which were of course very strong, I suppose that by the explosion (let us say August 27, 9.30) an immense mass of water was driven to the north, and escaped as far as it could into the Java Sea; probably other concussions followed, and afterwards the mass flew back (this was the wave the *Berbice* met with at 3 o'clock), and went into the Indian Ocean. If this supposition be true, I think Vlakte Hoek lighthouse was also struck by the wave in the afternoon (which, of course, I do not know). That the water was really dammed up, we learn also—though the effect was not so strong—from the report from Telok Betong about August 26. The men, being on the pier, had to make their way home through the water, which at the time was rather high, and they could never have done it if there had at that moment been a flowing off of the wave. From different reports it results that the waves produced their effect in a certain direction, and not around (e.g. destruction in the night 26th to 27th, Sirah, south of Anjer; 26th, in the evening, destruction at Merak, only slight commotion at Anjer).

2. The barometer. From the *Berbice* it is reported: 28 to 30 inches, violently agitated. *Annesley*: rising



and falling  $\frac{1}{2}$  to 1 inch in half an hour. *Prinses Wilhelmina* at Tandjong Priok : 789-763mm. (*Nieuw. Rotterd.* Nov. 26) (789 seems a misprint, *Nieuws van den Dag* has 750, perhaps it should be 759). *Loudon* : extremely high.

3. Compasses. Spun round (*Loudon*).

4. Degree of darkness. From all reports results that there was a moment when "no outlines of ship or men were seen." From the report of the *Annesley* results that the darkness continued after the downpour of ashes had ceased, therefore the darkness is not depending on the pouring down of ashes ; it is sufficient that the sunlight be intercepted by a thick cloud of ashes. From the *Berbice* is reported :—Darkness from 26th, p.m., to 28th, a.m. From all other places is reported :—Bright, August 27, from 6 to 9 a.m., and 28th, from 6 a.m.

5. After having read the reports, the question arose to me, Was the mud ejected from the crater, or were the ashes, &c., mixed with rain or sea water? I think the latter ; I remember, at least, that in 1863 (an eruption of the Merapi, Java, took place) I came into a slight downpour of ashes. I was travelling on horseback, and after some time a thunderstorm came on. All around me, which had been ashes before, was changed very soon into mud. In the report of the *Berbice* the "rain of mud" is not mentioned, but it is said that the yards were covered with a "crust," because a slight rain had met the ashes, which, however, on deck were still "ashes," because, I suppose, the rain was not hard enough to change such a thick layer into a "crust."

6. Detonations, though they were heard in Saigon, Singapore, Acheen, Ceylon, &c., were not heard on board the *Loudon*. I think this might be explained by the thunderstorm, the pouring down of mud into the sea, and the hurricane (which in Lampong Bay did more damage than the wave itself).

7. The part of Krakatoa which has disappeared sank probably August 27 ; at least in the report from the *Loudon* the island is described as it is now. From the *Berbice*, however, it is reported :—Saw it divided in three parts (29th) ; but probably they saw the remains of Krakatoa, Verlaten Island, and Lang Island, which before, when seen from the east, appeared as one island.

8. Sibessie was from the sea to the top buried under ashes (all people killed).

9. The floating pumice-stone was, in the Lampong Bay, in September, 14 feet thick ; in the Semungka Bay it was very strong too. Probably, if circumstances are favourable, new islands are to be formed ; though at the end of October steamers came to Telok Betong, in November a hopper-charge was, during eleven days in the Lampong Bay, beset by pumice-stone.

Besides this I beg to record :—

10. After the eruption of Krakatoa in the Indies many volcanic phenomena were observed, and they prophesied an eruption of Mount Merapi (Java) for February next. Whether they had heard of Mr. Delaunay's prophecies I am unacquainted with.

11. Up to November 1 they counted 32,635 persons killed by the eruption, &c. For the burial of the corpses the Government had spent 6000*l*.

When the Survey under my direction (1868-69) was busy connecting the triangles of Java with the Sumatra coast, the peak of Krakatoa was also chosen for a point.

Whether there were several hills on the island I cannot say, for when I saw Krakatoa it was covered with a splendid vegetation, and in such a case it is not so easy to judge of the configuration as it is when the trees are burnt, but I dare say there was only one peak.

Of the results of the Survey I keep only a map, of which I inclose a rough copy. From this it results that the signal was a little to the north of  $6^{\circ} 8\frac{1}{2}'$  ; Kuyper puts it in  $6^{\circ} 9'$ , which is certainly wrong ; he inserts also a peak in the centre of the island (622 metres), and says it had disappeared ; this is, I am sure, a mistake. If the

military survey (which was at work now) had not yet finished its work so far as to give a map of Krakatoa (though perhaps they have not undertaken a survey of the island, since administratively it belongs to the Lampongs, and not to Bantam), it might perhaps be useful to consult the notes of the *Geographische Dienst*, which are deposited in the Archives, and a sketch of the Sunda Straits, which I offered in 1875 to the Minister of the Dutch colonies.

E. METZGER

Stuttgart, January

## NOTES

WE regret to learn that Mr. C. W. Merrifield died at Brighton on New Year's Day at the age of fifty-six.

MANY of the friends of the late Dr. Hermann Müller in this country will be glad of the opportunity of testifying to their respect for his memory and their sense of the value of his work by contributing to the fund which is being raised to establish a "Müller Foundation." In the first instance the proceeds will be used to assist the widow of Dr. Müller during her lifetime, and afterwards as an endowment to some poor and deserving student at the Public School of Lippstadt desirous of devoting himself to natural science. An influential Committee has already been appointed on the Continent, including the name of Prof. Haeckel. The movement, we are sure, will commend itself to many of our readers, who may send their subscriptions either to Herr Stadtkämmerer Wilhelm Thurmman, Lippstadt, or to the care of the Editor of NATURE.

FIVE HUNDRED POUNDS in prizes are offered by Mr. Francis Galton for extracts from the family records of competitors. They are to be sent him before May 15, drawn up according to the conditions and under the restrictions published in his recent book, "Record of Family Faculties" (Macmillan and Co., 2*s*. 6*d*.), which contains full explanations, together with sufficient blank forms for the records of a single family.

M. BOULEY has almost unanimously been appointed Vice-President of the Paris Academy of Sciences for 1884, and President for 1885.

EARTH tremors seem to have been of almost daily occurrence in Tasmania recently. Mr. J. R. Hurst of Longwood, near Moorina in the north-east of the colony, sends to the *Launceston Examiner* of November 12 a record extending from August 31 to October 20, 1883, noting the occurrence of several daily, some of them so serious as to be alarming. In a note in its issue of November 19 the *Examiner* says :—"The vibratory motions of the earth's surface which have been so frequent for several months past still continue with a periodicity which is at least remarkable. Ordinary tremors now scarcely arrest attention, but occasionally a quivering of unusual severity startles those who happen to notice it, and reminds them that there are forces in operation in nature which are mysterious and appalling. One of these occurred yesterday afternoon about six minutes to three o'clock, which was felt in every part of the town, and set windows and furniture rattling. Some persons fancied that they could detect a distinct undulatory motion. The shock lasted for twelve or fifteen seconds. It may be mentioned that the whole of yesterday was very stormy—frequent and heavy showers of rain, with thunder and hail, and a very low barometer. Last evening the mercury began to rise."

PROF. J. P. LICHERDOPOL writes from Bucharest, Roumania, that on January 1, at 6.13 a.m., two horizontal shocks of earthquake, from north to south and *vice versa*, were felt there, and were preceded by a loud noise, as of a distant train coming from the north. The furniture was slightly shaken and crackings were heard. The atmosphere was calm, but charged with a very