"'The city of Samaskuta, which was situate in the interior of Sumatra, became sea, the water of which was very clear, and which was afterwards called the lake Sinkara.[1] This is the origin of the separation of Sumatra and Java.'"[2]

Whether we are justified in accepting this date (A.D. 416) as that at which the very grand eruption of Krakatão, and the accompanying subsidence which led to the separation of Java and Sumatra, actually took place, I am not prepared to say. It may be that, as in many similar cases, the floating traditions of a grand catastrophe attached themselves to a subsequent event of a similar character. It is certainly very interesting to learn, however, that in the fifth century very grand volcanic outbursts were taking place in the district in question; and that a belief existed in the former connection of the islands of Java and Sumatra. Nor is it unimportant to discover that tradition is in complete harmony with scientific reasoning in assigning the separation of the two islands to actions occurring concurrently with great volcanic outbursts.

In concluding this note, I must express my great obligations to Mr. Baumgarten and Dr. Rost for bringing these important records under my notice. JOHN W. JUDD.

[1] "The well-known Lake of the 'Menang-Kebo' country."

[2] See the "Krakatão Eruption and the Javanese Chronicles" in *Trübner's Record* for August 1889 (third series, vol. i. pt. 3).

On some Effects of Lightning.

PROF. McMILLAN's interesting letter in NATURE of July 25 (p. 295) contains some minute details of the effects of a lightning-stroke on a house near Calcutta, on June 8 last. I agree with the writer that such cases are of value to electrical science, especially when reported by a competent observer. In Prof. McMillan's excellent letter there is one word to which I object, and that is "vagaries," as applied to electricity at high potential. When lightning enters a house, it is as much subject to law as when it flashes from the cloud to the earth, and does not behave with the whim, caprice, or freak implied by the word "vagary." In the absence of continuous conductors, the electrical discharge drags into its path light, conducting substances, which assist its progress, and by means of which it can strike through considerable distances and in various directions, as in the case before us. As to the effect of the discharge on the air of the house, Mr. McMillan appears to have made a real advance towards the solution of a difficult problem—namely, What is the origin of the powerful odour produced by a lightning-discharge within an inclosed space, such as a room or a ship? In most cases, the odour is compared to that of burning sulphur —"the ship seemed to be nothing but sulphur," was entered in the log of the *Montague*, after having been struck by lightning. Now as far back as 1785, Cavendish's famous experiment proved that electrical discharges in a confined mass of air lead to the formation of nitric acid, and Liebig found that acid in seventeen samples of rain-water collected during thunder-storms. Nevertheless, with these facts before him, Snow Harris wrote: "From whence this odour arises is still an interesting problem in physics," and he declines to discuss "those chemical views which some able philosophers have entertained of the nature of the odour emitted." Arago also states that the odour is generally compared to that of burning sulphur; but he adds: "others compare it to phosphorus, others to nitrous gas"; and significantly remarks: "L'odeur de gaz nitreux serait le plus facile à expliquer." Now, Prof. McMillan has shown that nitrogen teroxide, more or less diluted with air, was sufficient in the case so ably reported by him, to account for the colour and odour of the atmosphere produced within the house by the electric discharge. "The whole house seemed to be filled with an orange-coloured gas, mixed with clouds of dust affecting the breathing like fumes of burning sulphur," is the description given by the occupier of the house.

Another point of interest in this valuable communication is the introduction of ball-lightning. Arago is sceptical as to the existence of ball-lightning (*éclairs en boule*), or that which moves through the air at a comparatively slow rate, appearing like a luminous ball or globe of fire. Faraday is also equally sceptical. But the well-attested cases of what we name ball-lightning, and the Germans *Kugelblitz*, are so numerous that they can no longer be termed, in Arago's language, "a stumbling-block (*pierre d'achoppement*) for meteorologists." Snow Harris properly describes these luminous balls as a kind of brush or glow discharge. In the well-known case of the *Montague*, the luminous ball was seen rolling on the surface of the water towards the ship from to windward; evidently a brush discharge, or St. Elmo's fire, produced by some of the polarized atmospheric particles, yielding up their electricity to the surface of the water. On nearing the ship, the point of discharge became transferred to the head of the mast, and, the striking distance being thus diminished, the whole system returned to its normal state—that is to say, a disruptive discharge ensued between the sea and the clouds, producing the usual phenomena of thunder and lightning, described by the observers as "the rising of the ball through the mast of the ship." In Prof. McMillan's case I do not understand his remark that "no second ball was seen to enter from the opposite side to meet the first, and so produce the apparent explosion." Surely a second ball was not necessary to produce the effect described—namely, "an intensely brilliant ball of yellow fire, about 6 or 7 inches in diameter, which passed from one end of the room to the other at a pace just sufficiently slow to allow it to be readily followed by the eye: it appeared to be momentarily checked, then burst with a deafening report, which shook the whole house." In other words, it passed from a brush into a disruptive discharge.

Lastly, we have another remarkable confirmation of the fact that a lightning-conductor does not afford protection to surrounding objects. According to the French theory, a lightning-rod affords protection over a circle equal to twice its radius. But there are numerous cases to prove that no such radius of protection exists. The *Endymion* frigate, at Calcutta, in March 1842, was furnished with a chain conductor on the mainmast, but the lightning struck the foremast, shivered the topgallant and topmast, and damaged the lower mast. The mast struck was not above 50 feet from the mainmast. A somewhat similar accident happened to the *Etna* in Corfu, in January 1830. So also in the case that excited so much discussion at the time, the Board-house at Purfleet was struck on May 12, 1777, at a point about 40 feet from the conductor. A similar case occurred at the Poor-house at Heckingham in June 1781. So also in the recent Calcutta case, there was a conductor at one end of the building, projecting 8 or 9 feet above the roof-level. But the lightning entered the house by an iron-covered hatchway, 70 feet from the conductor, and near to a shell factory, which bristled with conductors.

Prof. McMillan properly attaches great value to such cases as the one he reports, leading as they do to the conditions which should govern the protection of buildings. In the course of a long experience, I have noticed that the profession which should be the best instructed on the subject, is—I hope I may say was—the worst. When the new buildings for the Cholmeley School at Highgate were being erected, the head master consulted me as to the erection of a lightning conductor, and asked me to see the architect. That gentleman called on me and said, "We never put up these things; we don't approve of them. I never erected one in my life, and don't know how." I once visited a church in Rutlandshire, that had been restored by Sir Gilbert Scott. The rector took me to one of the gable ends, and said, "You see, we have a lightning conductor, properly insulated by means of glass rings." I replied that on visiting the granite lighthouse at the end of the Plymouth breakwater, I noticed that Faraday, in fixing a lightning conductor, had caused a spiral groove to be cut inside the shaft from top to bottom, for the insertion of a massive copper band, so as to make the conductor an integral part of the building. Snow Harris's method of protecting a ship applies also to a building. At whatever part of the ship or building the lightning may strike, it ought to find an easy metallic path to the sea, or to the earth. The late Prof. Clerk Maxwell, writing to me as to the best method of securing a building, proposed to inclose it with a network of good conducting material, such as a copper wire, No. 4 British wire gauge, to be carried round the foundation of the house, up each of the corners and gables, and along the ridges. Further details would occupy too much space on the present occasion.

Highgate, N., August 1. C. TOMLINSON.

SOME weeks ago, two trees were struck by lightning near St. Albans, in Hertfordshire, the effects of which are most unusual. The two trees stood near each other in a wood called Symonds Hyde Wood. Assuming that the lightning struck downwards, it is easy to see in one case where the damage began—namely, at a place where a branch had by some means been broken off formerly, leaving a ragged break, into which no doubt water had soaked. Thence for some feet downward the effect was