

In conclusion, I may say that these circumstances do not alter my conviction of fighting on the winning side. The reasons of my faith I hope to give in the next journal of the Royal Scottish Geographical Society. H. B. GUPPY.
17 Woodlane, Falmouth.

Snow Crystals.

YESTERDAY was very favourable for observing the beautiful appearance of sunlight reflected from snow crystals. As one walked across a field, stars appeared to start forth by thousands from amongst the fresh-fallen snow. They were particularly bright and numerous when one walked in the direction of the sun. They appeared almost at all distances, and almost of all sizes, those near at hand being never very large but of great brilliancy and most exquisite colour. The phenomenon was sufficiently striking to induce me to stop and observe it more closely, and the first thing I noticed on stopping was the permanence of each little star of light, although the snow was dropping melted from the hedges and trees by the heat of the sun. A slight movement of the head was sufficient to change the colour of a red star to green or *vice versa*. It seemed as if the most brilliant colours were seen when looking in a direction nearly but not quite towards the sun. The level surface of the snow appeared as if strewn with gems—and not only near at hand, for even twenty and thirty yards away a large star would shine forth with a subdued but fine colour. I then noticed a peculiar uniformity of shape in these reflections from snow crystals. The shape never varied from that of a blunt arrow-head. This was very striking in the large stars which appeared at a distance; but once noticed, it was obvious enough that even the minute specks at one's feet were all of this form. Nor did the position of the snow vary to any appreciable extent. The inclination seemed always a little to the right, and this occurred no matter in what direction I looked, whether towards the sun, or away from it, or in any other direction. Wishing to know the absolute size of the larger snow crystals, or combination of crystals, I looked for a fine appearance, and estimated as well as I could its magnitude by covering it with a small object held at arm's length. The distance of the spot where the crystal appeared proved to be forty-three paces from where I stood, and its magnitude could not have been much less than three inches in this particular case. Now if, as I suspect, the form of the star which appears so persistently is due to the upper or lower stem only of a complete arrangement of crystals in an hexagonal shape, these combinations must occasionally be six inches or more in diameter. I did not succeed in recognizing any larger than very minute arrangements of crystals in the snow itself, but it is obvious that the sun's rays reflected from a long distance must single out those faces of crystals which happen to be parallel to one another over a certain limited area. Observation of these reflections, therefore, calls in to our aid a power of analysis in the sun's rays to detect symmetrical arrangements of snow crystals quite unrecognizable by mere inspection. Might I ask for some explanation of the phenomena?

Hull, January 30.

A. N. S.

"The Mammoth and the Flood."

MR. HOWORTH's letter does little more than travel again over old ground, and two only of the points raised require any notice on my part; the third—the value to be attributed to the opinion of any particular geologist—being immaterial to the main question. As another President of the Geological Society has said: "Science needs no infallible Church, and admits of no Pope."

In regard to the localities in which mammoth remains have been found, I have not "resuscitated" any theory, but have taken my facts from Mr. Howorth's book. His second letter appears to me to ignore a distinction which I was careful to draw in my reply to his former one. That mammoth bones should be found at considerable distances from, and elevations above, the existing rivers, offers no difficulty. Indeed, they could not occur, except accidentally, in deltas which are now in course of formation. But, so far as I can ascertain, there is no reason why these "beds of clay and gravel" should not be deposits of rivers which drained the same regions under different climatal conditions, in the distant ages when the mammoth lived in Siberia. The case is precisely similar in England. We should not expect to find mammoth bones in the mud-flats about the mouths of our southern rivers, but in the old valley gravels which

occur sometimes even 90 or 100 feet above the present level of the rivers. But the facts most difficult to explain are the occurrences of the *carcasses* of mammoths. It was of these, and of these only, that I was speaking in my letter, as I think would be clear to most readers. No geologist, so far as I know, would deny that the Siberian climate has considerably changed since the mammoth wandered over its tundras, and very likely not seldom got bogged; but the question is, Has it changed suddenly or gradually? The occurrence of the frozen carcass is undoubtedly most simply explained by postulating a sudden change; but when we begin to consider what this means, the remedy, though apparently so simple, seems as heroic as that of the father "who cut off his little boy's head to cure him of squinting." It is then for the best preserved of these frozen carcasses that I suggest the possibility of a drifting and a gradual entombment by the deposits of the ancient rivers. I have again consulted Mr. Howorth's book, and find, between pp. 82 and 89, notices of the discovery of at least ten mammoth carcasses, mostly occurring very far north in Siberia, and nearly all mentioned in connection with rivers: of one it is even said, "like most of the others, it is found on the bank of the river, which had been undermined by floods."

Mr. Howorth further asserts that I cannot have read his book because I charge him with invoking a series of catastrophes when he argues "in favour of one catastrophe only." But, notwithstanding his disclaimer, I would like to know how we are to bring about a deluge to drown the mammoth and a sudden permanent fall in temperature to freeze his carcass (query, one catastrophe, or two?) without "a series of catastrophes." I presume that, as this is a scientific question, we must not invoke a miracle. If continents gambolled like whales—which would be needed for Mr. Howorth's far-reaching flood—would this, unless there were a very special arrangement of continents, so materially alter the climate? and, if they did so disport themselves, what set them dancing? If a number of insular volcanoes exploded with twenty-Krakatao force, this would be a series of catastrophes, but it would probably leave the climate unchanged. If the earth's axis of rotation were suddenly altered materially in position—perhaps the simplest mode of bringing about the two results—would no catastrophic changes be needed to effect this alteration? Mr. Howorth's retort, in fact, indicates better than anything which I can write how completely he has failed to realize the conditions of the problem which he attempts to solve.

But enough. It is impossible for me to continue this correspondence. The reviewer's task is often not a very pleasant one, but a new terror would be added to the work if it involved an interminable controversy with authors on matters of opinion. Dreading this, I deliberately abstained from signing the review, because I knew from past experience that this was my only chance of escape from the flood of Mr. Howorth's controversial eloquence, which, like the proverbial river, *Labitur et labetur in omne volubilis ævum*.

YOUR REVIEWER.

An Incorrect Footnote and its Consequences.

In following up Baltzer's erroneous reference concerning the "Demonstratio eliminatiois Cramerianæ," Mr. Muir, as described in his letter on p. 246, seems at first to have been singularly unlucky. For, on referring to the catalogue of Lord Crawford's mathematical library under "Mollweide," although the work itself was not immediately forthcoming, there was a cross-reference to "Prasse, M. von," under whose name the essay was duly catalogued. The Dun Echt copies, for there are two of them bound up in volumes of mathematical pamphlets, are copies of the original "Demonstratio," in 8 folios, with the pages 4 to 15 numbered, and the last blank. In a gap on the title-page of one copy has been written "auct. Mauricius de Prasse," apparently long ago, and in a German hand. But apart from this the last sentence of the first paragraph identifies the author as the writer of "Usus logarithmorum," which bears the same Latin form of the name in print.

The cross-reference is due to the presence in the library of a little book the title of which is worth giving in full, as it contains the names between which Baltzer's mistake arose, and it also gives the German form of von Prasse's name: it is "Logarithmische Tafeln für die Zahlen, Sinus und Tangenten, neu geordnet von Moritz von Prasse ehemals Prof. der Mathematik in Leipzig, revidirt und vermehrt von Karl Brandan Mollweide ordentl. Prof. der Mathematik in Leipzig. Leipzig,