Laramie group, an extensive brackish water formation in Western North America, which holds a transitional position between the Mesozoic and Cenozoic series. Associated with *Pyrgulifera humerosa*, among various other fresh and brackish-water forms, is one that I have described under the name of *Goniobasis cleburni*, which is evidently congeneric with the *Melania* (*Sermyla*) *admirabilis* of Smith, an associate of *Pyrgulifera damoni* and *P. crassigranulata* in Lake Tanganyika. As that lake has evidently once been a brackish water sea, it is not strange that there should be certain similarities between its molluscan fauna and the faunæ of similar bodies of water that existed in Mesozoic and Cenozoic time. It is, however, remarkable that the two generic types here especially referred to should appear in their integrity living in Africa, and not in North America, where the fossil forms occur; and especially so because so many of the fresh-water and land-molluscan types now living on the latter continent are found fossil in its Mesozoic and Cenozoic strata.

C. A. WHITE

Washington, D.C., November 4

Velocity of Wind

THE following observations regarding the velocity of the wind in the south-west gale of the 21st and 22nd of November at Edinburgh may be of interest. The observations were made by me about nine o'clock on the morning of the 22nd, when the wind had somewhat moderated :—

	Miles per hour.
Mean velocity	62·3
Velocity during a squall	71·6

These observations are calculated from the velocity of clouds of *smoke* issuing from the chimney of the Caledonian Distillery, and travelling for a distance of 2100 feet, and are thus free from instrumental errors. The chimney is 225 feet high, and its base is about 200 feet above the sea-level.

CHARLES ALEX. STEVENSON

Arctic Research

NO one can hold in higher honour and respect than I do the opinions of the greatest of Arctic navigators, Sir Edward Parry, although these opinions were expressed more than half a century ago, since when our knowledge of Arctic shores has very materially increased.

My letter in NATURE vol. xxv. p. 53, where alluding to navigable waters through channels, &c., in the Arctic Sea, specially referred to Arctic America and the lands lying north of it, in which category Greenland can scarcely be included, certainly not that part of its western shores along which a navigable passage is almost invariably to be found.

The following passages from the extract from "Sir Edward Parry's writings" (NATURE, vol. xxv. p. 78) are those which specially bear upon the statements made by me :—

"We experienced a striking example of this kind [ice obstruction] in coasting the eastern shore of Melville Peninsula in 1822 and 1823, the whole of the coast being so loaded with ice as to make the navigation extremely difficult and dangerous."

I do not in the least doubt this, but difficulties of ice-navigation are comparative, and I believe from Eskimo report that the opposite side of Fox's Channel would have been worse. On asking the natives of Repulse Bay why they did not go over to Southampton Island, which forms the eastern shore (having a western aspect) of Sir Thomas Roe's Welcome, the reply was, there were no seals or walruses there, the ice being too much on shore. The same is said of the east side of Fox's Channel.

The sea on the west side of Melville Peninsula is said never to be free from ice[1]; such was its condition during the summer of 1846; and in 1847, when I traced its whole shore, there was a fringe of heavy and rugged hummocks some miles wide all the way.

In the springs of 1847 and 1854 the opposite coast, being the west side of Committee Bay—having an eastern aspect—bore evidence, by the small quantity of rough ice met with, that there had been navigable water at some time during the previous summer.

There can, as a rule, be no better or truer guide to the *side* of a channel, inlet, &c., which is *least* ice-obstructed than the assembling of marine animals, seals, walruses, and whales (provided always that these animals have not been driven away by constant attacks to less favoured resorts) along its shores, on which the Eskimos have their chief camping-grounds, and of which there are many along the east shore of Melville Peninsula and southward on the same coast-line to lat. 64°, near which the Americans have had their chief whaling and sealing stations for many years.[1]

On August 19 and 20, 1859, Sir Leopold McClintock ran 150 miles down Prince Regent's Inlet, along the side, having an eastern aspect, to Bellot Strait, without seeing a bit of ice except one large iceberg, and returned by the same route in 1860 (August 10 to 16), but on this occasion was stopped near Fury Point by ice, forced in by a strong easterly breeze of four days' duration; when the wind changed to west the obstruction was speedily removed, and there was no further difficulty. Dundee whalers have not infrequently visited Cresswell Bay in this locality, and killed whales there. So much for shores having an eastern aspect being navigable, notably that of Smith Sound.

The second passage from "Parry's Writings" I wish to comment upon is—

"These facts, when taken together, have long impressed me with the idea that there must exist in the Polar regions *some general motion of the sea towards the west*, causing the ice to set in that direction, when not impelled by contrary winds or local or occasional currents."

When it can be proved that permanent currents exist in the sea, irrespective of wind influence, we must naturally assume that the motion of the sea and of the ice floating on it is in the same direction.

The *Resolute*, one of Sir Edward Belcher's ships, abandoned near the south entrance of Wellington Channel in 1854, must have driven eastward for 300 miles through Barrow Strait and Lancaster Sound, into Baffin's Bay, and was picked up far to the south by the Americans some years afterwards.

Sir Leopold McClintock in 1859 and 1860 found Bellot Strait free from ice, and quite navigable, entering from the east, but impenetrably blocked with thick old ice-floes at its western extremity. In his chart is a note: "Bellot Strait, flood and *permanent* current to eastward."

Sir Edward Parry experienced a somewhat similar permanent easterly current in the Strait of the Fury and Hecla, as the following extract from Capt. Lyon's (who commanded one of Parry's ships) journal (p. 275) will show: "That there was a prevailing set from the westward we had long known, even before entering the strait, and we saw by the driving of the loose ice against an easterly wind that it ran with great force. As an extraordinary instance in point, the *Hecla* broke adrift on the 13th in consequence of a piece of ice parting, and was carried (eastward) against a fresh easterly breeze, about a mile from the fast floe. All sail being set before the wind, we were nearly two hours in recovering this one mile, though to all appearance and by the log going between three and four knots through the water."

Here are examples of two permanent currents running to the east, through straits narrow, it is true, but the only passages known to exist in two lands extending about six degrees, or 360 miles north and south.

The conclusion to be arrived at seems to be, that the sea to the west of these lands is at a higher level than it is to the east of them, and consequently if the general motion of the "sea is towards the west," according to Sir Edward Parry's idea, it must, in the localities named, be moving in opposition to its own currents, or up hill.

J. RAE

4, Addison Gardens, November 26

ARE not the facts of ice-accumulations at "the western sides of seas or inlets," mentioned in your last number (p. 78), to be explained by reference to Baer's law for the flow of rivers? This law, corroborated by many observers in all parts of the world (see for instance NATURE, vol. xv. p. 207), states, as a simple consequence of the earth's rotation, the deviation to the right bank of all rivers of the northern hemisphere running north and south, *i.e.* to the west, if the flow is from the north, and to the east if from the south. Considered from this point of view, it may suffice that the masses of ice are borne by currents from the north, to account for the accumulations on the western borders of these currents, *i.e.* on "the eastern coast of any portion of land." I am well aware that the principle in question was applied to the theory of ocean-currents, long ere C. E.

[1] See Rae's "Arctic Expedition," 1846-7, p. 49.

[1] Along this shore, seal, walrus, and the right whale abounded in 1846, 1847, and 1853, when I was there. In 1854 constant easterly winds kept the ice close to the land for ten days, so that few marine animals were seen during that time.

von Baer extended it to the phenomena of rivers; the above case may be considered as connecting together both classes of phenomena.

D. WETTERHAN

Freiburg-im-Breisgau, November 26

Spectrum of the Electric Light

WILL you, or one of your spectroscopical contributors, kindly inform me in what respects (if at all) the spectrum of the electric light differs from that of the sun? At a time apparently not far distant from the almost universal application of the electric light, the question I ask is not unimportant, as it, I believe, affects the tolerance of the human eye for other than solar light. It is already well known that much work done by gas-light is by many found prejudicial to their vision, and this may, I presume, be caused by the inherent qualities of the light. It will be interesting to me therefore to learn in what respects electric light and gas-light differ from solar, as shown by spectrum analysis.

J. HOPKINS WALTERS

Reading, November 28

A GLIMPSE THROUGH THE CORRIDORS OF TIME[1]

II.

AT the remote epoch of which we are speaking the solar tides were very small, as they are at present. Yet, small as they are, there was a particular circumstance which may have enormously increased their importance. The point to which I refer can be illustrated very simply. We have here a weight of 14 lbs. freely suspended, and here I have a small wooden mallet which barely weighs half an ounce, yet small as this mallet is, I can make the heavy weight swing by merely giving it blows with the mallet. Let me try. I give the weight blow after blow. I hit it as hard as I can, yet the weight hardly swings. I have not yet been successful. The art of succeeding is merely to time the blows properly; this I am now doing, and you see the weight swings in an arc which is steadily augmenting.

We therefore see that a succession of impulses, in themselves small, can yet produce a great effect when they are properly timed. In the present case the impulses should succeed each other at the same interval as this pendulum requires for one to and fro oscillation. The time therefore depends on the body struck, and not at all on the body which gives the impulses.

Just as this pendulum swings with a definite period so the vibrations of the primæval earth had a certain period appropriate to them. Suppose that the liquid primæval globe were pressed in on two quadrants and drawn out on the two others, and that the pressures were then released. The globe would attempt to regain its original form, but this it could not do at once, any more than the pendulum can at once regain its vertical position; the protruded portions would go in, but they would overshoot the mark, and the globe would thus oscillate to and fro. Now it has been shown that the period of such oscillations in our primitive globe is about an hour and a half, or very close to half the supposed length of the day at that time. The solar tides, however, also have a period half the length of the day. Here then we have a case precisely analogous to the 14 lb. weight I have just experimented on. We have a succession of small impulses given which are timed to harmonise with the natural vibrations. Just as the small-timed impulses raised a large vibration in the weight, so the small solar tides on the earth threw the earth into a large vibration. At first these vibrations were small, but at each succeeding impulse the amplitude was augmented until at length the cohesion of the molten matter could no longer resist: a separation took place: one portion consolidated to form our present earth; the other portion consolidated to form the moon.

There is no doubt whatever that the moon was once quite close to the earth; but we have to speculate as to what brought the moon into that position. I have given you what I believe to be the most reasonable explanation, and I commend it to your attention. There are difficulties about it, no doubt: let me glance at one of them.

I can easily imagine an objector to say, "If the moon were merely a fragment torn off, how can we conceive that it should have that beautiful globular form which we now see? Ought not the moon to have rugged corners and an irregular shape? and ought not the earth to show a frightful scar at the spot where so large a portion of its mass was rent off."

You must remember that in those early times the earth was not the rigid solid mass on which we now stand. The earth was then so hot as to be partially soft, if not actually molten. If then a fragment were detached from the earth, that fragment would be a soft yielding mass. Not for long would that fragment retain an irregular form; the mutual attraction of the particles would draw the mass together. By the same gentle ministrations the wound on the earth would soon be healed. In the lapse of time the earth would become as whole as ever, and at last it would not retain even a scar to testify to the mighty catastrophe.

I am quite sure that in so large and so cultivated an audience as that which I am now addressing, there are many persons who take a deep interest in the great science of geology. I believe however that the geologist who had studied all the text-books in existence might still be unacquainted with the very modern researches which I am attempting to set forth. Yet it seems to me that the geologists must quickly take heed of these researches. They have the most startling and important bearing on the prevailing creeds in geology. One of the principal creeds they absolutely demolish.

I suppose the most-read book that has ever been written on geology is Sir Charles Lyell's "Principles." The feature which characterises Lyell's work is expressed in the title of the book, "Modern Changes of the Earth and its Inhabitants considered as Illustrative of Geology." Lyell shows how the changes now going on in the earth have in course of time produced great effects. He points out triumphantly that there is no need of supposing mighty deluges and frightful earthquakes to account for the main facts of geology.

Lyell attempts to show that the present action of winds and storms, of rains and rivers, of ice and snow, of waves and tides, will account for the formation of strata, and that the gentle oscillations of the earth's crust will explain the varying distribution of land and water. In this we can to a great extent follow him. I am quite satisfied with the oscillations in the land. If the land rises an inch or two every century in one place and falls to the same extent elsewhere, all that is required has been explained. Nor do I feel at present disposed to question his views as to rivers or to glaciers, to rains or to winds. There is however one great natural agent of which Lyell does not take adequate account. He does not attach enough importance to the tides. No doubt he admits that the tides do some geological work. He even thinks they can do a great deal of work. The sea batters the cliffs on the coasts, and wears them into sand and pebbles. The glaciers grind down the mountains, the rains and frosts wear the land into mud, and rivers carry that mud into the sea. In the calm depths of ocean this mud subsides to the bottom; it becomes consolidated into rocks; in the course of time these rocks again become raised, to form the dry land with which we are acquainted.

The tides, says Lyell, help in this work. Tidal currents aid in carrying the mud out to sea; they aid to a considerable extent in the actual work of degradation, and

[1] Lecture delivered at the Midland Institute, Birmingham, on October 24, 1881, by Prof. Robert S. Ball, LL.D., F.R.S., Andrews Professor of Astronomy in the University of Dublin, and Royal Astronomer of Ireland. Contributed by the Author. Continued from p. 82.