used for steadying the body in walking. In man the arms are used, because most movable; but in lower animals the head is most often used. The domestic fowl moves the head back and forth alternately with the movement of the legs; the horse moves the head up and down; the cow moves the nose back and forth.

Are these movements ghosts of a former real walking with the head? JOSEPH LECONTE.

Berkeley, Cal., March 7, 1883.

Suggested improvement in lighthouses.

The articles in SCIENCE during March, on the use of the electric light in lighthouses, recalls what I think is a most useful improvement suggested, or at least advocated, by an English yachtsman, — Mr. R. F. McMullen, — in a little book called the 'Voyage of the Orion.' In the vicinity of a powerful lighthouse, whether lighted by electricity or otherwise, the great glare of the light completely blinds the eye of the navigator. To remedy this, Mr. McMullen proposes that a colored shade should be fixed so as to change the color of, and diminish, the light within a fixed radius of from one to three miles, according to circumstances. Thus, besides the protection given the eye from too much glare within the radius of the shade, the navigator would also be warned that he was within a known distance of the light, — a consideration which would often be of much value.

I sincerely hope that our Lighthouse board may make some experimental trials of this plan, as well as turn its attention to the adoption of flashing lights, instead of revolving lights with long periods of darkness. Indeed, in our whole system of lights, and also of buoys and other 'day-marks,' we are behind the times. EDWARD BURGESS.

Boston society of natural history,
March 12, 1883.

Fluidal cavities in quartz-grains of sandstones.

It is interesting to note that the minute cavities containing a liquid and moving bubble, so common in the quartz of granite rocks, are also to be found in sandstones. This is especially the case with a hard, compact Potsdam sandstone quarried at Fort Ann, Washington county, N.Y. The cavities, though very minute, are abundant, and the included bubble very sensitive, being in a constant state of rapid movement. G. P. MERRILL.

U.S. national museum.

The copper-bearing rocks of Lake Superior.

In SCIENCE, No. 5, Professor Irving takes issue with my statement that there is no evidence whatever of the Lake Superior copper rocks holding any other place in the geological series than that which includes Potsdam and primordial Silurian or lower Cambrian.

In making the statement, I referred only to those parts of the north shore, extending from Sault St. Mary to Thunder Bay, which I have myself examined.

I could not presume to discuss, much less to dispute, the evidence which Professor Irving adduces, in disproof of my statement, from the St. Croix region and the south shore, neither of which I have ever seen; but I may be permitted to say, that the unconformities mentioned by Professor Irving, and which I have no doubt are real, do not, in my opinion, in the least invalidate my statement. Unconformities, even if locally very great, are not necessarily any indication of a great time-gap. And it seems to me that too much importance has been attached to these by Professor Irving, and far too little to the immense difference in the physical condition of the groups he now correlates; viz., the original Huronian of the north shore of Lake Huron, and Hunt's Animikie group, lower Cambrian of Thunder Bay, or, to come closer, the cleaved roofing-slates of Thompson in Minnesota, and the horizontal micaceous argillites, black dolomites, and cherty rocks, of Pie Island, McKay's Mountain, Thunder Cape, etc.

In Canada, at least, these two formations are absolutely and undoubtedly distinct, physically, mineralogically, and geologically; while the latter, as seen around Thunder Bay, is followed in almost conformable sequence by the red and white quartzose sandstones, conglomerates, amygdaloids, etc., of the so-called upper copper-bearing or Keweenian series of Hunt. These I have examined from Thunder Bay, around the north shore to Gros Cap, where they rest directly on the Laurentian gneiss, the Animikie group and the underlying Huronian being wanting. A short distance to the east, however, the latter appears in full force, but overlaid neither by Animikie nor by Keweenian (i.e., lower Cambrian), but by the Sault St. Mary sandstones, which, in view of their relation to the Black River limestone above them, and to the Keweenian in Gonlais and Bachewarmg Bays, are much more probably representative of the horizon of the St. Peters sandstone, or Chazy and calciferous, than of the St. Croix Potsdam. The respective limits of the two sandstones on the south shore seem uncertain.

The arrangement above indicated brings the whole succession of the Lake Superior, Cambrian, and Cambro-Silurian formations into perfect accord with that of the same formations in the Appalachian region, where, as I have elsewhere stated, indications of local contemporaneous volcanic action are not wanting at about the same horizon — lower Cambrian and upper Huronian — as that at which they occur in the Lake Superior region; the chief difference being, that the formations in the former region are folded and metamorphosed almost past recognition, and in the latter not more so than are many similar rocks of cretaceous and tertiary age.

I think, if Professor Irving could visit Michipicoton Island, he would be able to recognize plenty of volcanic detrital matter or tuffs among the copper-bearing rocks. The vast areas over which I have examined the ejectamenta of the extinct tertiary volcanoes of Australia enables me very readily to recognize such rocks when seen; but their occurrence at Michipicoton, and elsewhere on the north shore, is no proof that they also occur to the south, and therefore I fail to see why Professor Irving should dissent from my statement on this point.

ALFRED R. C. SELWYN,
Director Geol. and nat. hist. surv. of Canada.

Ottawa, March 14, 1883.

Snow-drifts.

Having often noticed the drifting of snow in parallel lines over the ice on our lakes, this explanation has suggested itself. Very often, when the wind drives the snow against any object, as a tree or fence-post, the snow will be hollowed out on the side toward the wind, and heaped up on the other side. This is explained by the fact that the tree acts as a reflecting surface, creating a counter-current of air, and preventing the accumulation of snow on the side toward the wind.

Might not the parallel ridges of snow on ice be explained in the same way? The first deposit of snow is caused by the flakes catching on some inequality or damp spot on the ice. This deposit acts as a re-