ture in the room, transported a very heavy piano from one side of it to the other, and then departed, taking with them most of the articles of furniture of a light character.

Facts of this kind forcibly show how great the encroachments of the sea must have been within a comparatively short time. Men do not usually build houses in situations thus exposed; the encroachment of the sea has rendered their sites perilous. And though it is happily true that such storms are not of very frequent occurrence, nevertheless many of us can remember so many of them that we cannot but look for them in the future; that is to say, we recognise them as part of the system of nature, not necessarily destructive on every coast, but by no means of very limited range, and certainly an important part of the machinery now modifying the crust of the earth.

ON THE EXCESS OF WATER IN THE REGION OF THE EARTH ABOUT NEW ZEALAND; ITS CAUSES AND ITS EFFECTS.

BY JAMES YATES, M.A., F.R.S. AND G.S.
(Member of the Geological Society of Manchester.)

The author, adopting from Professor Guyot ("Earth and Man," translated by Mr. Clarke, of Batterssea) the terms "land-hemisphere" and "water-hemisphere" to distinguish the portion of the earth which includes "the four quarters of the globe" from that portion which consists mainly of water, observed that instead of the old distinction between the northern and southern hemispheres, the cultivators of physical geography have now made a much more accurate statement of the facts by assuming a point in the South Pacific Ocean, not far from New Zealand, as a centre, around which the entire waters of the globe appear to be collected. He referred to the Physical Atlas of Berghaus, published in Berlin, as containing the most accurate representation of this view of the subject, and thought that this has the highest authority, because, in constructing it Berghaus was assisted and directed by two of the most eminent of his fellow-citizens in this department of science, Alexander von Humboldt and Professor Karl Ritter. The author mentioned that English geographers have prepared maps which give the same general view, but take London and the antipodes of London as the two centres, in order to accommodate English conceptions. He exhibited the beautiful Training-school Atlas, just published by the Messrs. Philip, of London and Liverpool, as containing the largest and best examples of representation. It appeared necessary, however, instead of regarding the waters as ramified in every possible way by their distribution into oceans, seas, bays, and straits, to collect them in imagination into one; hence, preserving Berghaus' centre, which is situated in the meridian of a hundred and seventy degrees east longitude from Paris, and in about four hundred and thirty south latitude, the author presented on a diagram "an Ideal Section of the Earth in the Meridian of New Zealand." Two points in the circumference of this section, named A and B, represented the division between the collected land and the collected water, and the author produced statements from Professor Rigaud of Oxford, Professor Link of Berlin, Alexander von Humboldt, and Sir John Herschell, all tending to show that the entire amount of land on the surface of the globe being taken as a hundred, the entire amount of water will be two hundred and eighty-nine, or nearly so. He took the exact number, two hundred and eighty-nine, because it is the square of seventeen, one hundred being the square of ten. He thought that by the adoption of these numbers, the points A, B in the diagram might be exactly fixed, and that the chord joining them would divide the land (in the section) from the water

with a great approach to accuracy, and, moreover, that this chord might be easily drawn on his diagram, because twenty-seven, *i.e.*, ten and seventeen, being also equal to three times nine; it is extremely easy to divide the circle in the manner required by using its radius in the ordinary way. A diameter bisecting this chord at right angles, and drawn to the supposed centre of the water-hemisphere, forty-three degrees south latitude, necessarily passes both through the geometrical centre of the earth, and through its centre of gravity. As the basis of this construction of the diagram, it was assumed that the two constituent areas of the earth's surface, consisting of land and water, are as the squares of the arcs by which they are bounded.

The author briefly controverted the statements of Peterman and Sir John Herschell, who ascribe the appearance in question to "tumefaction," or the "superior intensity of the causes of elevation in northern latitudes, and in former geological epochs," observing that if earthquakes and volcanos are evidences of such superior intensity, the elevated land ought to be on the opposite side of the globe, since the volcanos are three times more numerous in the water than in the land-hemispheres. He wished to ground his speculations on existing facts, and regarded them as proofs that as one half of the moon is probably heavier than the other half, so the earth is heavier on the water- than on the land-side. He supposed the greater weight on the water-side to be produced partly by an excess of mineral veins, beds of ironstones, and basaltic rocks, with others of high specific gravity on that side, and partly by an excess of hollows and cavities filled with water on the other side. Hence would result the conclusion, admitted by Sir J. Herschell, that the earth's centre of gravity is different from its centre of form, or geometrical centre. The author was proceeding to show how the amount of this eccentricity might be computed with some approach to accuracy, but the President expressed the opinion, in which the author cheerfully concurred, that a subject, the treatment of which required so much of mathematical demonstration, was better adapted to be pursued in another section.

Besides the diagram already referred to, the author showed another containing a list of ten of the highest mountains dispersed through the land-hemisphere, and of ten dispersed in like manner through the water-hemisphere, for the purpose of illustrating the fact that the mountains of the land-hemisphere are uniformly of a much greater elevation above the sea-level than those of the water-hemisphere. The heights of all these mountains were given in metres.

The sums of the heights of the one group and of the other, by striking off a cypher at the end of each, gave the average heights of the mountains in each group. Regarding them as gauges for measuring the depth of the ocean, and presuming that the mountains, which rise above submerged continents in the water-hemisphere, and present their summits in the form of innumerable islands, are, generally speaking, and relatively to the solid sphere of the earth, equal in elevation to the mountains of the land-hemisphere, the author drew the conclusion that the general depth of the ocean (its central portion) may be taken as approaching to two kilometres, and that the depths much exceeding this must be attributed to local disturbance.

ON ISOMETRIC LINES, AND THE RELATIVE DISTRIBUTION OF THE CALCAREOUS AND SEDIMENTARY STRATA OF THE CARBONIFEROUS ROCKS OF BRITAIN.

By EDWARD HULL.

As it is intended that this paper shall be laid before the Geological Society of London, only a short abstract can be presented here.

The author endeavoured to show that during the Carboniferous period a barrier