positive axes, exhibited any difference in the laws of diamagnetic action, from those which had negative axes?

Prof. Faraday replied, that Prof. Plücker had minutely investigated this point, and found no diversity of law corresponding to this difference in optical structure.

Sir D. Brewster inquired whether Prof. Plücker had investigated the influence which changes of temperature produced in the diamagnetic action of crystals? Some of these changes, he conceived, were of such a nature as to afford an admirable test, whether the same circumstances in the corpuscular constitution of the crystal, on which their optical characters depended, were those which gave rise to their diamagnetic relations, or not. For example, in some of the biaxial crystals, as sulphate of lime, when heated, the axes approached, and at length coincided,—the crystal becoming monaxal; and by continuing the heating, they again separated in a plane at right angles to the one in which they before lay. Such a series of changes, he conceived, if examined in relation to the diamagnetic forces, might afford a test whether the curious properties discovered by Prof. Plücker, had their origin in the chemical constitution of the bodies, or in that corpuscular structure from which their optical properties originated.

Prof. Plücker replied, that he had not tried the class of experiments pointed out by Sir D. Brewster; but he admitted their importance, and expressed a determination to pursue the inquiry.

Prof. Grove inquired whether the experiments were tried with the crystals placed in *vacuo*?

Prof. Plücker replied no; but in every case they were suspended either in air or in water.

Prof. Grove pointed out the necessity of caution in that case, as it was well known that differences between the diamagnetic actions of suspended bodies, and of the surrounding medium, would sometimes mask, and even reverse the action.

Prof. Faraday pointed out the precautions which had been taken to avoid this source of error.

Ibid.

On the Submergence of Ancient Land in Wales; the Accumulation of newer Strata around and above it; and the Re-appearance of the same Land by Elevation and Denudation. By PROF. A. C. RAMSAY.

This communication was illustrated by a section, on a true scale, of the rocks near Builth, in Radnorshire, where the Wenlock shales rest unconformably on the Llandeilo flags. The lower rocks must have been elevated previously to the formation of the upper, and their upturned edges must have been worn away by the sea, when the upper rocks were deposited, or previously. No power is known to exist far below the level of the sea, by which this process could have been effected; it must have taken place at the sea's level.

Throughout Wales, the Lower Silurian rocks appear to have been disturbed at one particular period—to have been heaved above water, and formed a coast, around which the succeeding rocks were accumu-

lated. Near Bishop's Castle, the upheaval of the Llandeilo flags was followed by the deposition of the Caradoc sandstone, which is full of pebbles of the older rocks. After this, a subsidence appears to have taken place, the area of the sea was increased, and the Wenlock shale was deposited, not only over the Caradoc sandstone, but beyond it, as at Builth, upon the Llandeilo flags; and in some places the shale rests on Greenstone rocks, and certain pebbles from it, being in fact a gravelly sea bottom. This depression of the bed of the sea continued also during the deposition of the Ludlow rocks, which are conformable to the Wenlock shale; and there is no marked alteration in the organic remains of the two rocks. The Wenlock shale is 1500 feet thick, and the Ludlow rocks 3500 feet; and as it is certain that their organic remains could not have existed at the depth of 5000 feet, we must suppose a gradual subsidence of the area, such as is believed to be now taking place amongst some of the coral islands, until 5000 feet of rocks was accumulated over what had been dry land.

The old red sandstone, which has a maximum thickness of 8000 feet, appears also to have extended over this country, judging by the outliers, at a considerable distance to the north and west. Subsequently, the whole of this series, from the Caradoc sandstone upwards, was removed, and the ancient Silurian strata became the surface of dry land, as they had been so long before.

It now became a question, what amount of alteration may the Silurian rocks have undergone, during the time they were so covered up? If the same laws regulated the ascent of the internal temperature as at present, namely, 1° for every 54 feet, then the addition of 5000 feet of rock would have raised the temperature by 92° , whilst 9000 feet would have added 160° , and with 11,000 feet of superincumbent strata, the Lower Silurian rocks must have endured an increased temperature of 212° . To influences of this kind may, perhaps, be attributed the crystalline or metamorphic condition of some of the more ancient rocks,—as suggested by Sir J. Herschel, in a paper communicated years ago to the Geological Society of London.

The Dean of Westminster referred to the Portland rock, in which a bed of vegetable soil occurs, full of trunks of trees, and cycadites; this bed rests on limestone containing ammonites, and is covered by similar marine deposits. Again in the Weald, fossil forests, and beds of freshwater shells are found above marine accumulations, and followed by the greensand and chalk. At the present time we find peat, and antlers of the red deer, in the bed of the channel, several miles off Swansea. On the Norfolk coast, and in the English Channel, are found the bones of the elephant, and fossil wood, disinterred from former cliffs by the action of the sea. These, with many other circumstances, were quoted as showing that, whilst the sea-level was fixed, the land had suffered depressions and elevations at many periods of time.

Prof. Phillips pointed out the extent of some of these subsidences of the land; for example, the old red sandstone, 8000 feet thick, all formed in shallow water, and the coal measures 11,000 feet thick, and added under similar circumstances; and inquired what condition of the interior of the earth can have admitted of the gradual subsidence of such great masses of strata? According to Mr. Hopkins's statement,

it was improbable that the interior would *now* admit of it. With respect to the augmentation of temperature which would follow on the addition of several thousand feet of strata, it should be remembered that the communication of heat from below, through such rocks, was remarkably slow; and the law of the distribution of internal temperature could not be assumed the same in ancient as in modern times.—As to the level of the sea remaining unchanged, this was only assumed for security in geological reasoning; there was evidence in the Malvern of a sea-level 600 feet above the present, but it was impossible to say whether that ancient level was nearer the *centre of the earth* when formed than now.

Lieut. Col. Portlock communicated some observations on apparent changes in the level of the coast near Portsmouth, and contended that, as these evidences of subsidence could be traced back to the most ancient times, so they had continued up to the present day, and expressed his conviction that a parallel might be found in existing nature to all the phenomena of ancient times. It appears that Fort Cumberland, near Portsmouth, stands on a bank of gravel and sand, and that, owing to some new wall made to protect it from the sea, a fresh direction was given to the tide, and a portion of the bank undermined and washed away, in the course of which a thick plank with a bolt was discovered, showing that the basis of the fort had no great antiquity. An artesian well has also been made to supply Blockhouse Fort, which shows, for the first 60 feet, nothing but clean shingle, and then a layer of sandy clay, full of common oyster shells.

Prof. Oldham exhibited a section of the hills known as the Chain of Kildare, in Ireland,—a low range, running N. E. and S. W., amidst bogs and flat country. They consist of a great mass of trap, succeeded by alternating slates, sandstones, and trap, calcareous rocks, shales, slates and sandstones,—all forming one conformable and regular series, elevated at an angle of from 45° to 70°. Resting on the edges of these rocks, and filling up the hollows, is the conglomerate of the old red sandstone, succeeded by the carboniferous limestone. On the flanks of the hills, and rising nearly to their summits, is a great deposit of modern drift, attaining a thickness of 200 feet in sheltered places. The section afforded evidence of several periods of elevation above, and depression beneath, the level of the sea; and it was alleged to be an object with the geologist, to map the surface of the land at each period of the earth's history.

Prof. Ramsay remarked, that he had not intended to imply that the level of the sea remained absolutely the same, as every deposit in it must raise its level; but he wished to protest against the doctrine, that the ancient sea-beds and beaches, high above the sea, in South America, and elsewhere, had attained their altitude through any subsidence of the sea, instead of the elevation of the land.

Mr. Greenough contended that the level of every sea, and of the ocean, was constantly undergoing changes.

Mr. Benson alluded to the occurrence of ripple-marked sandstones, in the Pennant grits of South Wales, which indicated a subsidence of those beds from near the sea level, to a depth, in some places, of 2000 feet.

Ibid.