That this in outline is what geological history tells has happened in the neighbourhood of Liverpool, I have no manner of doubt. Similar movements of the land, not necessarily in this order or of the same frequency, are registered all round the coasts of England and Wales, Scotland and Ireland, as shown by dock or other excavations where the submarine geology can be explored.

Whether my hearers agree with me or not in the details of these land movements, he would be a bold man who would deny that they have occurred on a large scale during the periods named. Admitting the fact, the interesting question remains, what is the cause of these frequent oscillations of level. One favourite explanation at the present time is that it is the effect of isostasy, of a loading and unloading of the earth's crust by sedimentation and denudation. Let us examine this: the glacial deposits cannot average so much as 200, probably not 100, feet in thickness; the effect of such a loading would be inappreciable on the earth's crust, whatever view we take of the constitution of the earth's interior. If the addition of the glacial deposits cannot affect the foundations of the earth, still less can their partial denudation create a rise of land. The same reasoning applies with greater force to the post-Glacial deposits, as they are neither so extensive nor so massive. Alterations of the sea-level seem to me out of court, simply because such fluctuations must arise from gravitation to land masses, thus creating a greater difficulty to account for a lesser one, as the land masses have to be moved first before the water of the sea can follow.

Mr. Shone has suggested that the subsidence of the peat and forest beds has been due to subterranean erosion, but they occur at too regular levels and in too many places to render this a feasible explanation. Ice in the Glacial Period accumulating in great thicknesses on the land has been appealed to as a cause of submersion, and its melting of emergence. This is a more plausible suggestion, because there is nothing to bind us in our idea of the load, which we can pile up in imagination to any extent, but unfortunately it does not explain post-Glacial movements which are demonstrated to have taken place, not only by the facts I have laid before you, but by the shore terraces found in various places around our Islands.

It appears, then, that these pulsations of the land are not due to external causes, but to causes hidden from us in the earth's interior.

VI.—ON THE OCCURRENCE OF CORUNDUM PRODUCED BY CONTACT-METAMORPHISM ON DARTMOOR.¹

By Professor K. Busz.

SOME three years ago, when travelling in Devonshire, I had the opportunity of visiting some places on Dartmoor, and of collecting on the border of the Dartmoor Granite some specimens of rocks, which on closer examination seemed to be of general

¹ An abstract of this paper was read before the British Association, Liverpool, September, 1896.

interest. Although I have not finished the examination of these, yet I have made some remarkable observations, which I should like to describe to the readers of this Magazine.

It is well known that the Dartmoor Granite is the largest of the numerous granite exposures of Devon and Cornwall. As to its origin and age, there have been brought forward very many different views and theories. Whatever these may be, it is, I suppose, generally understood that this granite-mass is of post-Carboniferous age. The Devonian, as well as the Carboniferous strata and their interbedded contemporaneous igneous rocks, have undergone great alteration at their zone of contact with the granite.

The place I visited, where these alterations are well exposed, is near South Brent, on the south end of the Dartmoor Granite, where a little stream, the Avon River, cuts right through the contact-zone.

The rocks affected by the contact-metamorphism are of different characters. I found Devonian clay-slate altered into chistalite-slate and spotted mica-slate, while small seams of interbedded limestone have given rise to the formation of garnet and other minerals.

I may mention here that I found close to South Brent on the right side of the Avon River one of these limestone-layers, of about two yards' width, almost entirely changed into garnet. This garnet, grossularia (calcium-iron-garnet), is of a light-brown colour, and either shows the very well-developed form of the dodecahedron or occurs in granular masses with no distinct crystallographic form; it shows a very strong, anomalous, double refraction, and also very distinctly the partitioning into sectors described by Professor Klein. The crystals are sometimes imbedded in a saccharoid-grained white mineral, which chemical analysis proved to be the lime-felspar anorthite. Besides these, malacolite and axinite occur abundantly in this locality.

It may perhaps be of interest to mention that I have found Cassiterite to be present in some of the andalusite-bearing schists. It occurs not only imbedded in the long-shaped crystals of andalusite but also in the groundmass of the rock, and exhibits well-defined crystalline forms, which very often show the well-known twinning.

By the aid of hydrofluoric and hydrochloric acid I succeeded in isolating these crystals for chemical analysis.

All these alterations of the schists surrounding the granite, which we may call exomorphous contact-metamorphism, are of course very common, and can be observed more or less intensely developed in every granite-mass. Not so common, but, on the contrary, rather rarely observed, is endomorphous contact-metamorphism, and it is the latter to which I desire to draw the attention of your readers.

In the above-mentioned locality I found in close contact with clay-slate a felsitic porphyry, which, in a light grey-coloured groundmass, contained a few small but rather well-defined crystals of plagioclase. One specimen which I was able to collect consists, one half of this felsitic porphyry, the other half of clay-slate altered into black hornfels. The latter is very much broken,

and the irregular-shaped pieces are surrounded by felsitic matter. The microscopic examination showed that the felsite contained a great number of very small colourless crystals, which sometimes show distinct hexagonal outlines and contain minute black inclosures. These crystals accumulate round the pieces of clay-slate, and decrease in number the further away from the slate one examines the slice. I have for some time been very much puzzled as to what this mineral could be. By dissolving a portion of the rock in hydrofluoric and hydrochloric acid a white powder remained, which under microscopic examination proved to consist solely of the crystals in question. By analyzing these I found nothing but alumina and very small traces of iron-oxide, probably due to the minute black inclosures, which I suppose to be magnetite.

I then tried to determine the hardness. I put a little of the powder between two cleavage-flakes of topaz, which after a little rubbing soon lost their lustre and became perfectly dull. There can be no doubt, therefore, that the mineral in question is corundum; and also, considering the manner in which it occurs, that it is not an original constituent of the felsitic porphyry.

My belief in regard to the origin of this corundum is this, that the eruptive rock, when the eruption took place, partly dissolved and absorbed the broken pieces of the clay-slate, and that afterwards in this felsitic matter, which was then supersaturated with alumina, the crystallization of the corundum took place on cooling.

We are aware of the fact that corundum as a product of contact-metamorphism is very rare, and has, indeed, only lately been described in one or two cases, which, however, are quite different from the occurrence on Dartmoor. I therefore thought it would be of some interest to record this discovery, all the more as it is, so far as I know, the first instance of the occurrence of corundum in this way in the British Islands.

VII.—ON THE OCCURRENCE OF SILLIMANITE GNEISSES IN CENTRAL ANGLESEY.¹

By EDWARD GREENLY, F.G.S.

IN the course of some traverses of the central region of Anglesey recently made, preparatory to mapping it out in detail, I observed a few facts which, in spite of the evident complexity of the structures, can, I think, be safely described before completion of the map, and are of some interest in connection with other recent researches in gneissose areas.

The region in question (see descriptions by Sir A. C. Ramsay, Dr. Callaway, the Rev. J. F. Blake, Sir A. Geikie, and others) extends across the island in a north-easterly direction from Llanfaelog to near Llanerchymedd.

To the south-west of the Holyhead Road granite appears to occupy the greater part of the surface, but to the north-east a complex system

¹ An abstract of this paper was read before the British Association, Liverpool, September, 1896.