on such a conclusion; nor will any one who has had a wide experience of the ways and means by which terrestrial features have been modelled. Dame Nature is not so short-handed, that where one agency fails, she cannot find another. If Vulcan is at work in one place, so also is the Ice King of the North in another. For my part, I believe that in the formation of lakes numerous physical causes have at various times, and in divers places, come into play. In the Jordan Valley it may be concluded, from the scanty observations of travellers regarding its geology, that there has been a great fracture ranging along the base of the Moabite table land. In the case of Balaton Lake there may have been a subsidence in a volcanic district; in that of Lough Neagh, fractures of the strata before the Glacial Period; in many large lakes in the centre of Ireland, there has been the dissolution of the limestone by water charged with carbonic acid gas; and in the Cheshire plains there has been subsidence due to the melting of subterranean beds of salt, as Mr. Ormerod long since suggested. These are all diverse processes by which lakes are formed by other than glacial erosion. But none of them apply in the cases of the rock-basins of British mountains and other districts where the evidences of glacial erosion are so striking, and where there are no evidences of recent fractures of the strata, nor of volcanic terrestrial movements, nor of solution of calcareous beds, nor of solution of beds of salt. On the other hand, in default of other agencies, we are forced to recognize the influence of those which have evidently been at work in these districts; and I cannot think that, in throwing over so completely the theory of glacial erosion for all lakes, Mr. Judd has sufficiently weighed the grounds for its acceptance, which have from time to time been advanced by its author, Professor Ramsay, or by those who support his views, such as Gastaldi of Turin, or James Geikie amongst the "Scotch Geologists."

I may observe, in conclusion, that both in the original memoir in the Journal of the Geological Society, and in the *Physical Geology of Great Britain*, Professor Ramsay especially eliminates "crater-lakes, lagoons, and the lakes of Central Africa," from the class of lakes to which his theory applies; so that Mr. Judd's objection has been anticipated by the author of the theory himself. (Phys. Geol. and Geog., 3rd ed. p. 173.)

Geological Survey Office, Dublin,
January, 1876. Edward Hull.

MR. JUDD ON GLACIAL EROSION AND SUBAERIAL DENUDATION.

Sir,—To fight other people's battles, especially when the other people are perfectly well able to take care of themselves, is palpably unnecessary, and might smack of meddlesome interference; besides well-intentioned advocacy is liable to damage even a good case, unless the advocate is specially fitted for his task; and then—but no, I won't go on. I have given reason enough why I should not try to discuss the arguments advanced by Mr. Judd in your January Number against the theory of the Glacial Erosion of Rock Basins.

But there are one or two points in that paper which I do feel less

diffidence in approaching. With a large portion of Mr. Judd's remarks I am confident that a very considerable majority, if not all, even of the most enthusiastic supporters of the theory of Glacial Erosion and of the doctrine of the sculpturing power of Subaerial Denudation, will most cordially agree; indeed, if a few paragraphs had been omitted, I doubt if any one would have been found to raise a word against the paper. But in his anxiety to make his arguments as clenching as possible, Mr. Judd seems to me to have resorted to that easy and safe way of securing a triumph, which consists in setting up a dummy adversary in order to have the satisfaction of knocking him down again.

Two classes of geologists are alluded to who appear to me to be pure phantoms of the imagination. The first are those who hold that "all the existing rock-basins have been produced by ice erosion." Where are these exquisite specimens of the man of one idea to be found? Who ever said that Lake Balaton, Lough Neagh, the Dead Sea, or the Victoria Nyanza were excavated by glaciers?

What I must look upon as the second dummy is the geologist who asserts that "the production of the features of the earth's surface is entirely due to the action of denuding agents, and that subterranean forces have played no part whatever in the matter." Here again I don't know where to lay my fingers on the man; if he ventures to show his face, he will assuredly receive as little mercy at the hands of geologists in general as has been accorded him by Mr. Judd. Such a doctrine is too palpably inconsistent for the veriest beginner to accept it for a moment. Before denuding agents can carve out hill and valley, they must have something to work upon; the material they have to fashion is either a derivative rock formed under water, or a crystalline rock that once lay deep down in the bowels of the earth. Without subterranean forces how are we to get a rock of either class within the reach of denudation to begin with? Again, what is it that has caused the main lines of drainage to run in many cases in the direction of the dip and directly athwart the strike of the rocks? Is it not one of the most fundamental parts of the theory, which assigns the formation of the surface to subaerial denudation, that it was the prevalent direction of the dip of the underlying rocks that determined the first slope of the surface and gave the initial direction to the flow of meteoric water? So far from subterranean forces being ignored, subaerialists have all along maintained that it was through them that the trend of the first formed rivers was decided. Further, who has been bold enough to assert that great mountain chains have been wholly cut out by denudation? Has it not been all along maintained, that while all the lesser details of their contour are due to that cause, their superior elevation is very largely owing to a concentration of the energy of subterranean forces along certain zones of the earth's surface? A theory well borne out by the excessive contortion which is always found in lofty ranges. I might add much more in support of my point, but I think I have said enough to show that the geologists who are the objects of such well-founded horror on Mr. Judd's part, are not to be found either among the advocates of the possibility of rock-basins having

been scooped out by glaciers, or in the ranks of those who have with such ability insisted on the important share which subaerial denudation has played in producing the shape of the surface.

I need scarcely add that I do not write for professed geologists; to them nothing that I have said will be new, and they do not require cautioning: but there must be many of your readers who would accept a statement coming from so high an authority as Mr. Judd without question; to such I may give a word of warning, and remind them that even Homer was not exempt from the failing of an occasional nap. Whether Mr. Judd was napping, and a vivid imagination conjured up during his dreams a spectre so repulsive to a philosophical mind that there was no resource but to write him down immediately, I can't say. Some great authors are reported to have composed during sleep; but however the curious mistake into which I cannot help thinking he has fallen has arisen, all who know Mr. Judd will agree that there cannot possibly have been any intentional misrepresentation.

A. H. Green.

Leeds, *February 12th*, 1876.

ELEVATION AND SUBSIDENCE OF LAND IN JERSEY.

Sir,—It may interest your readers to know that in addition to the indications of subsidence of land in Jersey, described by Mr. Peacock in his paper lately read before the Geological Society,[1] there exist indubitable proofs of elevation of the coast of the island.

Close by Elizabeth Castle in St. Aubyn's Bay, there stands the picturesque pinnacle of the Hermitage, in the rock of which St. Helerius is said to have impressed his holy body. At the base of the Hermitage, on the northern side, is a very fine raised beach. I have had an opportunity of examining this, and found it to consist of light-coloured, not very coarse, shingle and sand, containing an abundance of shells of species now flourishing on the adjacent shore. I visited this raised beach again in the autumn of 1874, intending to investigate it more carefully, and then found that, in the progress of the harbour works, it had been turfed over and rendered inaccessible.

On the opposite side of St. Helier's Harbour, under Fort Regent, there is a somewhat doubtful specimen of a raised beach. The harbour works here, however, have disclosed proof that the land stood formerly at a lower level; the workmen, in blasting and cutting back the rock (syenite), have quarried away a sea-worn cave running inland some twenty or more feet, and high enough (so the workmen informed me) to admit a man erect, and containing syenitic boulders of all sizes, rounded and shaped by the breakers.

A comparison of levels would probably facilitate the determination of the chronological sequence of these (geologically) recent subsidences and elevations of land in Jersey. I have not yet, however, had an opportunity of making it. *If* it be true that St. Helerius[2] lived in the Hermitage Rock, it is at any rate obvious that the littoral accumulation at its foot must in his time also have been a raised

[1] See abstract of Mr. Peacock's paper, *ante* p. 130.

[2] One antiquary fixes his date somewhere in the ninth century; another in the latter half of the sixth.