A case in point is the supply of Wisbech, together with many villages in the Fens, from a spring that breaks out at the edge of the Fen in the valley of the Nar, at Marham, some seven miles south-eastward of Lynn.

Of fairly large supplies got from beds below the Upper Chalk, in the Basin of the Thames, Luton and the Chiltern Hills Waterworks (near Tring) may be mentioned. Several smaller towns, too, depend on the same beds, along the northern outcrop of the Chalk. On the south the outcrop of the lower beds is narrower, but various wells have been carried through the Upper Chalk to these beds, as in the case of the Kenley and Caterham Waterworks. Maidstone gets a great part of its supply from Lower Chalk springs, and Folkestone gets the whole.

As a general rule there is more or less communication downward through the Upper and Middle into the Lower Chalk, so that the water in the Chalk may usually be treated as a whole. Nevertheless there are cases where, from the occurrence of less permeable beds in the Chalk over certain tracts, there may be independent supplies at various depths, and cases in point have been alluded to above, with regard to the Melbourn Rock being underlain by clayey beds, and to the Totternhoe Stone as a local water-bearing bed. There seem, too, to be cases, even in the midst of the Upper Chalk, where, from the occurrence of more compact beds at certain depths, there is some division in the water; and again, where strongly marked joint-planes are of rare occurrence, but fairly open where they occur, we may have lateral division in the water flowing through the Chalk, and this water may therefore take the form of more or less defined and separate underground streams.

In conclusion, I would point out that though there are *general* rules as to water in the Chalk, these must not be taken as *universal*: we must be ready for exceptions, and sometimes for great ones. To give what may be called a political illustration—whilst there are imperial laws regulating the conduct of water in the Chalk kingdom, yet the various provinces of which that kingdom is composed need special legislation of their own: rules that hold in one province may not accord with the manners and customs of another [and the same holds for still smaller districts]. In short, it is a case not only for Imperial but also for Local Government.

NOTICES OF MEMOIRS.

Geological Society of South Africa.

I.—Inaugural Address by the President, Dr. Hugh Exton, F.G.S.

AFTER some congratulatory remarks on the installation and progress of the Society, Dr. Exton referred to the interesting studies to be made in various branches of Natural Science, including particularly Anthropology and Geology. The pioneers of Geology

in Africa, Mr. A. G. Bain, Mr. Wylie, and Mr. Stow, had opened the way to the solving of many interesting problems, such as the origin of the great bed of breccia crossing the continent, known as the Ecca, or Dwyka Conglomerate, and the formation of the great valleys dividing the wide areas of Karoo strata, some of the latter comprising rich Diamond-fields and valuable Coal-fields. Still further, the consideration of the nature and origin of the backbone of the Cape country and the Transvaal, whether granitic or quartzitic, often highly auriferous, offer grand opportunities for geological explanation and discussion. Nothing in the known world approaches the banket reef of Witwatersrand, either in the area of country through which it extends, or the average uniformity in its mineral richness. If we consider that within the past twelve months there has been an output of gold to the value of seven millions sterling, and when we see from the working of new companies, and from the more scientific methods of treating the ores, that this output is steadily increasing, we may feel confident that these gold-fields form a centre to which the whole civilized world is looking with profound admiration and eager expectation.

"But there is another factor in connection with the gold-mining industry which we accept too readily as a matter of course, and that is the coal supply, not considering the utter impossibility of working the mines without the steam-power generated by coal; since the supply of wood for fuel (which was used in the early days of the Rand) not only failed to keep pace with the growing demand, but by its great expense stopped the development of the poorer mines, and threatened to render the cost of production in the richer mines greater than the value of the gold obtained. So far back as 1854 Dr. Sutherland directed attention to the existence of coal in Natal. Mr. Dunn's observations, made on behalf of the Colonial Government, were published in 1879, the chief results of which consisted in establishing the relation of the Ecca beds and Karoo series to the coal-seams of the Cape Colony. Indeed, up to 1883, so little had been done by way of proving the existence of workable coal-seams that Professor Green, in his Report to the Colonial Government, recommended that 'suitable rewards should be offered for the discovery of coal as likely to be attended with useful results.' Active search has resulted in discovering the existence of coal at various points over a wide extent of country. It is, of course, of the highest importance that coal should be free-burning and have the property of giving out heat; and these qualities are acknowledged to have been deficient in the coal obtained from seams first opened out in the colony. Professor Rupert Jones has summarized the reports of Mr. Dunn, Mr. North, Professor A. H. Green, and others, who all agree in attributing the deposits of coal to vegetable matter subsiding in fresh-water lakes. The absence of marine fossils was also noted by each observer. Subsequent flooding of such lakes by currents bearing sand and mud would account for the shales with which the coal is so plentifully interstratified. Evidence of the coal having been formed from drift vegetation lies in the

absence of an underclay beneath the coal-seams, such as is generally found below European and American coal-beds, and in which the roots of *Stigmariæ* and other plants are to be found. According to the observations of Mr. Draper, the coal now being worked at Vereeniging, by Messrs. Lewis and Marks, has a soft layer of whitish clay underlying the coal; but, as if to prove the futility of applying general theory to each particular case in South African geology, this underlying clay is apparently a decomposed sheet of dolerite, which had intruded below the coal, and, in many parts, penetrated into it, changing the coal into coke in the neighbourhood of the intrusion, and giving it more the nature of anthracite throughout its area. The endeavour to establish a geological horizon for the coal-beds in South Africa has not hitherto led to much practical result. We have Professor Seeley's recent opinion that coal must not be looked for below the strata containing the remarkable characteristic fossil reptilia. Further, we have Mr. Stow's original deduction that coal would be found from 70 to 150 feet below the silicified tree-stems which he traced over a large area in the north of the Cape Colony, and over a still greater extent in the Free State, and which he termed the forest zone. . . . . Mr. Stow's prediction that the coal would be found to crop out on the north-west of his forest zone has since been abundantly verified at the Vaal River. Nothing like a true Carboniferous system has yet been made out for South Africa; and though ferns, such as *Glossopteris*, have been found, this and some others are looked upon as survivals of Carboniferous plants into Jurassic times."

After some observations on the Coal-beds in the Stormberg and at Lake Nyassa, of the same Karoo series, Dr. Exton concluded with an exhortation to geologists to lose no opportunity in elucidating the many interesting and, indeed, most important problems lying at their feet in the subterranean strata, and before their eyes in the many and varied escarpments of hills and mountains around them.

II.—Glacial Progress. By Captain Marshall Hall, F.C.S., F.G.S.

[From the "Alpine Journal," No. 128, May, 1895.]

SINCE the appointment of the Sub-Committee upon Glacier Observations[1] sufficient time has not yet elapsed for many exact data to have come to hand, with one very brilliant exception—that of New Zealand.

Amongst the explorers of the Southern Alps are men not only mountaineers, but who are also greatly interested in these problems, shrewd observers and efficient officers of the New Zealand Survey. We have the novelty of new excursions, combined with the determination of a series of positions upon which to found future measurements, and all this in mountain ranges till recently scarcely known. The writer will give a summary of this work (with great conciseness, the result of instructions he has received). In the

[1] Geol. Mag., 1895, March Number, p. 144.