SIR,—Mr. Dixey's special pleading for the use of the term "magnesian", and for the setting up of a third great group of igneous rocks co-ordinate with the alkaline and calc-alkaline suites, carries little conviction in its train.

The impropriety of the term "magnesian" is sufficiently evident on inspection of a series of first-class analyses of rocks of the charnockite series, from any of the well-defined provinces such as those of Southern India or Western Norway.

The ground of Mr. Dixey's paper was largely covered by H. S. Washington in 1916 in his paper on "The Charnockite Series of Igneous Rocks" (*Amer. Journ. Sci.*, vol. xli, pp. 323-38), but with somewhat different conclusions. In summing up the chemical characters of charnockite provinces, he was led to state that "they are characterized by the dominance of iron oxides over magnesia and lime, the two latter being present in about equal amount".

One word with regard to the concluding paragraph of Mr. Dixey's letter. Mr. Dixey has missed the point of my remarks if he has not perceived that the reaction discussed was in no way dependent on any intrusion of norite by a later member of the series.

The cordierite-norites of Minnesota described by Winchell (*Amer. Geol.*, vol. xxvi, 1900, p. 151) afford an even more instructive illustration of the development of hypersthene than those of the Huntly area cited. The normal gabbro from which the cordierite-norites are developed by assimilation of aluminous sedimentary material, is free from rhombic pyroxene, while the cordierite-norites are free from the monoclinic type.

The inaccuracy of the reaction I have stated for the disappearance of diopside, when cordierite appears, can be admitted when Mr. Dixey can produce cordierite-norites, which, apart from armoured relics, contain monoclinic pyroxene, as in the gabbros or norites with which they are associated.

C. E. TILLEY.

THE ENGLISH ESKERS.

SIR,—Professor Gregory scores. The passage quoted by me from the Geological Survey Memoir on the Yorkshire Coalfield does refer, I agree, to mounds which only in part belong to the Lanshaw Delves series, and not at all to the Delves themselves. *Touché!* The fact remains, however, that Carvill Lewis specifically mentions "Laneshaw Delves, and limekilns have been built upon them". So Professor Gregory is honourably acquitted of ignoring two statements of the fact; he ignored only one. I will not labour the point of whether Russell's "four-tenths" of the great Memoir on the Yorkshire Coalfield includes the passage under discussion, but content myself with remarking that the quaint "harbour-bar" hypothesis for the Bingley Mounds is found also in his early paper in the B.A. report for 1873.

One more confession I must make. The lithographer who twenty-eight years ago transferred the Drift details from the map of the Geological Survey to illustrate my paper on the York Moraines did, to gain some private end, omit a pink spot one millimetre in breadth and I failed to detect the omission and so incur the awful penalty. Why Professor Gregory attaches any importance to it I fail to see. The rest of his criticisms of my remarks on the phenomena about York so ingeniously evade the real issue that rather than weary the readers of the GEOLOGICAL MAGAZINE with their discussion I will ask those who are interested to compare Professor Gregory's original statement with my comments and his rejoinder.

I may remark that though I adhere to my early opinion that the Fulford-Escrick ridge is an esker (using the word in a generic sense), its precise mode of formation demands careful investigation, especially in view of the occurrence of Mammalian remains in or beneath the gravel.

I must now revert to the Lanshaw Delves and their interpretation, for here are exemplified those characteristics of Professor Gregory's glacial work that, in my judgment, outweigh all the good that might conceivably be found in parts of it.

It will conduce to an understanding of the case if we suppose that Professor Gregory ascended the steep moorland path from Ilkley Station (300·6 O.D.), keeping in mind Carvill Lewis's description of the Lanshaw Delves and the signs of old lime-kilns, and the description in the Geol. Surv. Memoir of the ridges "composed of limestone-boulders mixed with pebbles and sand," . . . "They lie partly on Boulder Clay and partly on ground free from this deposit."

He finds it to consist of "sandy loam with many angular blocks of Millstone Grit similar to those strewn over the adjacent moors. . . The smaller pebbles include vein quartz and jagged fragments of black chert; and all these may have been derived from the Millstone Grit". His inference follows that this was the remains of a moraine of "an embryo corrie glacier". "The depression between the summit and the Delves faced N.E. and was probably filled with a sheet of snow and ice." The reason for coming to this conclusion in preference to Carvill Lewis's view that it was the lateral moraine of a great glacier filling the valley of the Wharfe to this altitude (about 1,180 feet) is given by implication in a passage that I must quote at length.

"The high-level eskers south of Ilkley are said in the Survey Memoir to rest partly on boulder clay, but I saw nothing to confirm this statement regarding Lanshaw Delves or any erratics, boulder clay, or other trace on the moor of any general glaciation of the district. The surface is littered with blocks of grit formed by weathering in situ. Even at the level of 600 feet in a quarry at Eldwick, on the southern side of the moor, the deep decomposition of the sandstones

indicates that there had been no glaciation at that locality. My observations agree with the generally accepted view that the hills of this district have not been covered by a general ice-sheet, and that the only extraneous ice in this part of the Aire Valley lay on its floor."

This is surely explicit—no boulder clay, no erratics (limestone here would be erratic), none but rock weathered in situ.

The allusion to the quarry at Eldwick is one of the author's most unfortunate touches. Messrs. Jowett and Maufe, two geologists who have achieved distinction by glacial work in other areas, show in their paper previously quoted by me that between this spot and the narrow crest of the moor there are six noteworthy lake-channels, two striated surfaces, one being at 1,080 feet O.D. While their map shows the ice-margin at a little above 1,200 feet O.D. This quarry, therefore, was covered by more than 600 feet of ice!

True, Professor Gregory was familiar only with the title of the paper until my criticism brought it to his notice, but as it "was entitled 'The Glaciation of the Bradford and Keighley District', I did not expect to find any account of the Delves in it". Seeing that Professor Gregory dealt also with the Drift mounds at Bingley which is midway between the two towns named, it is surprising, that he did not refer to it for that purpose; indeed, there is something humorous in the thought of Professor Gregory's profound research into the meaning of the word "Delves" with the aid of Wright's *English Dialect Dictionary* and the *New English Dictionary*, while neglecting this important paper.

As to this word Delf, every map of the district on the 6 in. or 1 in. scale would furnish examples of its common colloquial use, not in those rare and recondite senses disinterred by Professor Gregory. We have the following: "Coopers Cross Delf (Disused)," "Dry Beck Delph (Disused)," "Derry Hill Delph," "Odda Delph (disused)," in each case with hachuring to indicate a quarry, the common meaning of the word.

Now as to the occurrence of limestone erratics, Professor Gregory never mentioned them in his paper, and the whole context ascribes the Delves and their contents to the Millstone Grit, including the black chert; moreover, he says specifically that he saw no "erratics", and the whole case for his corrie glacier depends upon the Delves being beyond and above the general glaciation. Now he informs us that he did not say or conclude that there was no limestone in the Delves. Neither did he say there was no Shap granite there. In fact, he told us what he did find, and not what he did not. He now suggests that any digging in the Delves may have been to obtain limestone from underlying boulder clay—a material he was unable to find and clearly considered to be absent. This is not the scientific method, but the methods of the special pleader in the leading case of the borrowed bucket.

As it is many years since I went over the Delves, I walked the length of them yesterday. I found the lime-kilns much less com-

plete than formerly, but along the southern side alone there were at least ten quite recognizable by the craters and by the fire-reddened stones with which they had been lined, though only rarely was a part of the lining standing. As to stones, Millstone Grit was the chief constituent, black chert, often crinoidal, was quite common, but Carboniferous limestone was very rare except about the tops of the kilns, where pebbles were freely scattered. Bits of good coal could also be found near the pits. The general appearance of the Delves is very striking and—*pace* Professor Gregory—unmistakable; for the whole length of the ridge the form is quite obviously artificial—dimples, craters, and trenches everywhere modify the surface, one great trench runs for scores of yards parallel with the northern margin. On the south side spurs project, often with the crater of a lime-kiln. I confirmed my earlier impression that not a yard of the original form was preserved.

There is a small isolated knoll, "Little Skirtfull of Stones," consisting wholly of cobble-stones without infilling; this I regard as a cairn—probably prehistoric—and not a moraine mound.

P. F. KENDALL.

CARBONIFEROUS NOMENCLATURE.

SIR,—All geologists, and particularly those connected with Carboniferous geology, are grateful to Dr. R. Kidston for replacing the old and provincial subdivisions of the Coal Measures by terms of correlative value, dependent on their floras as worked out by himself, Arber, and other palæobotanists. The words Lanarkian and Staffordian are both precise and euphonious, Radstockian at least precise and indicative. The fourth term, Westphalian, however, is not only "unconformable" to the others in having no "local habitation" in this country, but differs in spirit from the rest in that it seems to suggest that these, our richest measures, are not typically represented in Britain. Worse than this, the term has been preoccupied since 1893, when Munier-Chalmas and de Lapparent used the word in a wider sense, equivalent to the whole of Kidston's three lowest divisions. If, as seems advisable, the use of the term Westphalian in the restricted sense is abandoned, it would be difficult to select one more representative than "Yorkian", particularly as its only likely rival "Lancastrian" may conceivably be wanted in the end for another Carboniferous subdivision.

W. W. WATTS.

IMPERIAL COLLEGE, S.W. 7.
8th March, 1922.

THE STRATIGRAPHICAL VALUE OF FORAMINIFERA.

SIR,—In view of the interest now displayed in the possibility of utilising the foraminifera associated with oil deposits as zonal fossils,