

certain knowledge which enables me to say with a high degree of certainty whether a flint has been fractured by blows or by pressure, and that in consequence these views have received definite and solid support. I hope Mr. Warren will agree to accept these proposals, and that the result of my examination of the flints to be fractured shall appear in the pages of this journal.

J. REID MOIR.

CONCERNING LATERITE IN GUIANA.

SIR,—In 1911 I contributed an article to this Magazine entitled "What is Laterite?" which arose from a discussion in these pages, initiated by a review of Professor J. B. Harrison's work, *The Geology of the Goldfields of British Guiana* (1908). In this article I put forward a tentative system of classification of lateritic products, by which I proposed to test the use of the word *laterite* by certain authors. Amongst the work criticized was a paper by Professor Harrison entitled "The Residual Earths of British Guiana commonly termed 'Laterite'", in the *Geol. Mag.*, 1910, pp. 439–52, 488–95, 553–62, and also that of Du Bois entitled "Beitrag zur Kenntniss der Surinamischen Laterite", published in *Tschermak's Mittheilungen*, 1903. I drew the conclusion (*loc. cit.*, pp. 563–4), judging from the work of Harrison and Du Bois, that the term has been too widely used in the Guianas.

Last year I received from Professor Harrison a letter to which, owing to the distractions of furlough and travel, I have not been able, hitherto, to give the careful consideration it deserves. From Professor Harrison's letter it appears that my conclusion given above is too sweeping, and therefore in justice to Professor Harrison I am making this communication.

I cannot do better than quote a section of this letter:—

"With reference to the various points in my published papers noticed by you I may mention that I had not an opportunity of correcting the proofs, and hence there are in the papers some wordings which would have been amended if I had had such an opportunity; the copies I send you have been so corrected. Among them is the heading to Table I, on p. 441.¹ The object of that table is to illustrate the somewhat diverse nature of *sedentary* soils covering areas of aluminous laterite. This is clearly seen by reference to the last sentence of p. 440. Unfortunately, in copying the analyses, the word 'Ironstone' over the word 'gravel' in the fourth column of the table was omitted.

"During 1897–1902 I analysed several specimens of 'ironstone gravels' and found them to contain from 80 to as much as 95 per cent of iron and aluminum hydrates, principally the former. These bring up the lateritic constituents of some of these soils very materially, for instance:—

	$\text{Fe}_2\text{O}_3 + \text{Al}_2\text{O}_3$
Hiamaraka Hill soil	72 per cent
Arakaka	56 "
Konawaruk Road, 12 miles	33 "
" " 14½ "	55 "
Woopu	72 "
Issorora	65 "
Malali	62 "

¹ Which Professor Harrison corrects from "Analyses of Laterite Soils" to "Analyses of Soils on Laterite".

But there are others resting directly on aluminous laterite or even bauxite that are practically, if not entirely, free from lateritic constituents; prominent among these are the soils at Akyma and at Christianburg, both of which are sedentary soils resting on beds of bauxite."

This correction invalidates my criticism on p. 562 (*loc. cit.*) to a large extent, and many of the products which I suggested should only be termed *clay, soil, or sand*, with or without the adjective 'lateritic', are obviously *argillaceous* and *siliceous laterites*.

Later in his letter Professor Harrison writes:—

"The specimens I described in the paper were all collected from low altitudes—below 500 feet—whilst many of them were from altitudes 20 to 180 feet only above sea-level. There are, however, as shown by C. B. Brown, during his geological survey of the colony, vast areas of the higher lands of British Guiana, 2,000 to 5,000 feet in altitude, covered with layers of concretionary ironstone gravels of lateritic origin.

"Recently an extended survey for railway purposes has shown that a vast area of British Guiana in altitude from 500 to 1,500 feet is covered by a ferruginous laterite which in composition corresponds to your definition of 'Typical Laterite', but which we have always termed 'ironstone'. It justifies from your point of view van Capelle's description of another part of Guiana as 'le pays de la latérite par excellence'."

In view of these remarks of Professor Harrison, it cannot be doubted that there are in the Guianas wide spreads of laterite. One feature in which the laterites of Guiana tend to differ markedly from those of India is the frequent presence of *secondary quartz*, which has been observed both macroscopically and microscopically by Professor Harrison in lateritic products derived from basic rocks originally containing little or no free quartz. This secondary silica is of such importance in places that it has segregated into quartz veins and reefs, which are sometimes auriferous (see pp. 446, 447, 489 of Harrison's paper). Many other authors, quoted on p. 490 of Professor Harrison's paper, have described auriferous quartz of secondary origin in the Guianas, e.g. Du Bois (*loc. cit.*, pp. 21, 22), so that it seems impossible to doubt that frequently in the Guianas the process of lateritization has not been pushed to a finish owing to the non-removal of at least a portion of the silica of the original rocks. This may be due to the fact that, according to Harrison (*loc. cit.*, p. 560), "in the dense forests of the Guianas there may be said to be a perpetual wet season, as under the shade of the trees, even during periods of comparative drought, the land is invariably wet and more or less soaked with water containing organic acids in solution." This last passage suggests that the ground-water level is very close to the surface, thereby rendering difficult the thorough drainage of the decomposing rocks. If this be so, then it seems as if the process of lateritization requires for its *completion* some condition, such as *the alternation of wet and dry seasons* so characteristic of many tropical lands, that will facilitate the periodical drainage from the soil of its contained solutions.

It would be interesting to learn whether there are in British Guiana any masses of laterite entirely free from secondary quartz, and, if so, whether such occurrences can be correlated with and explained by local topographical and climatic conditions.

L. LEIGH FERMOR.