The structures occur in quartz-microcline-oligoclase-biotite schist, within a half-mile of the very extensive South Savanna biotite granite. In some of the more biotite-rich enclaves they closely resemble Miss Knill's examples both in size and in the relative proportions of core and mantle, but cordierite is absent while sillimanite in the mantle is accompanied by andalusite idiomorphs. Usually, however, the structures are larger—up to 10 cms. across—while the cores measure only one or two cms. in the largest examples. Quartz, plagioclase and iron oxide occur throughout core and mantle, and in the surrounding schist. In addition to these minerals the core usually carries coarse green-brown biotite and cordierite which is commonly poiciloblastic and appears to have replaced most of the original constituents of the rock. The mantle carries, on the contrary, no biotite, but abundant fresh microcline, which has usually induced an albite-enriched rim in the plagioclase in contact with it. In addition, muscovite, together with small granules of new quartz, appears to have been derived largely from the microcline in mantle and unaltered schist. The biotite of matrix and core is identical, and appears to have recrystallized last of all. Sillimanite is sometimes present, but in the core rather than in the mantle.

Nearer the granite, more aluminous segregations develop, at first as clots carrying quartz, cordierite, and sillimanite, and associated with the cores described above. These finally develop into lenticles carrying coarse quartz along the axis, with 10 to 15 per cent of sillimanite together with some cordierite and plagioclase. The margin carries the usual clot minerals—quartz, biotite, plagioclase with minor sillimanite, muscovite—and in addition some green chlorite.

The accompanying sketches and AKF diagram show the form of the structures and summarize the mineralogical trends involved in the differentiation into core and mantle, and in the later development of alumina-rich veins. There appears to have been no volume change, at least in the former, so that an overall access of potassium must follow from the small relative size of the core. The development of the veins likewise indicates an access of aluminium from outside the system.

I should like to thank Professor Deer for his kindness in enabling me to use laboratory and X-ray facilities in connection with the structures described.

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C. N. BARRON.

GEOLOGICAL SURVEY DEPARTMENT,
BRICKDAM,
GEORGETOWN,
BRITISH GUIANA.

16th January, 1960.

IRISH EROSION SURFACES

SIR,—In the course of his study of altimetric frequency graphs, Mr. G. L. Davies (1958) has drawn attention to the similarities in the graphs, based on 20-foot groupings, for ten of the southern counties (Dublin, Wicklow, Wexford, Tipperary, Waterford, Cork, Kerry, Limerick, Clare and Galway) and the similarities in the graphs for ten of the northern counties of Ireland (Mayo, Sligo, Leitrim, Donegal, Tyrone, Londonderry, Antrim, Down, Armagh and Louth). He has shown that maxima occur fairly frequently at certain heights and, he suggests, that this accordance is rather too frequent to be dismissed as mere chance. In fact, the occurrence and coincidence of peaks *can* be partly attributed to chance and, on a purely statistical argument, some of the erosion surfaces deduced from the altimetric frequency graphs are of very doubtful significance. Indeed, for the northern counties, they are clearly of no significance at all.

In order for the frequency in a group to be a maximum it must exceed the frequencies in adjacent groups. Thus, in order to determine the chance of a peak occurring it is necessary to look at the group frequencies in sets of three. If there are N groups altogether, the total number of sets of three is N − 2. In each set of three there are six possible permutations, of which two will have the highest value in the middle ; the probability of a peak occurring by chance in a set of three is, therefore, $\frac{1}{3}$. Thus, in a series of N groups the number of peak frequencies expected, by chance, is $\frac{1}{3}$ (N − 2). For each of the ten southern counties considered by Mr. Davies there are fifty-one groups, using the 20-foot groupings. The expected number of peaks in each county is, therefore, $\frac{1}{3}$ (51 − 2) ; that is, $16\frac{1}{3}$. In Table A the observed number of peaks is set out, together with a probability value which indicates the probability of the difference between the observed number and the expected number occurring by chance. For an N exceeding about ten, the probability distribution of peaks is approximately normally distributed about the expected number with a variance of $\frac{16N - 29}{180}$ (see Kendall (1955)). Only in the case of Dublin is the observed number of peaks associated with a very small chance probability ; for this county, therefore, there may be a systematic movement in the group frequencies associated with a theory of erosion surfaces.

For the aggregate 510 groups, adopting similar reasoning, the expected number of peaks is $169\frac{1}{3}$. The observed numbers are 156, in the southern counties, and 158 in the northern counties. The probabilities of these discrepancies occurring by chance are 0·0476 and 0·0910 respectively.

TABLE A.—SOUTHERN COUNTIES—NUMBER OF PEAK FREQUENCIES

County	*Observed Number of Peaks*	*Chance Probability*
Dublin	12	0·0340
Wicklow	15	0·5156
Wexford	18	0·4180
Waterford	13	0·1030
Tipperary	14	0·2542
Cork	16	0·8728
Kerry	17	0·7414
Limerick	19	0·1936
Clare	17	0·7414
Galway	15	0·5156

Apart from the actual number of peak frequencies, Mr. Davies has remarked on the occasions on which peak frequencies have coincided in the different counties. The number of coincident peaks, again taking the 20-foot groupings, is shown in Table B. Set against the observed numbers are the theoretical values which would be obtained if the coincidence of peaks is attributed purely to chance. These theoretical numbers have been computed using the binomial expansion $(p + q)^n$, where p is the probability of a peak frequency ($\frac{156}{510}$ in the case of the southern counties, $\frac{158}{510}$ in the case of the northern counties), $q = 1 - p$ and n is the number of counties in the group. The respective individual items in the expansion give the probabilities of 10, 9, 8, 7, etc., peaks coinciding by chance.

TABLE B.—DISTRIBUTION OF COINCIDENT PEAK FREQUENCIES

Number of Peaks Coinciding	*Southern Counties* *Observed*	*Expected*	*Northern Counties* *Observed**	*Expected*
10	—	0·0	—	0·0
9	—	0·0	—	0·0
8	1	0·1	—	0·1
7	4	0·5	1	0·6
6	5	2·0	3	2·1
5	3	5·6	6	5·7
4	3	10·5	10	10·7
3	12	13·6	12	13·6
2	10	11·6	10	11·3
1	7	5·8	7	5·6
0	6	1·3	2	1·3
	51	51·0	51	51·0

$\chi^2 = 12{\cdot}04$, for $n = 3$; $P = 0{\cdot}01$. $\chi^2 = 1{\cdot}42$, for $n = 3$; $P = 0{\cdot}70$.

(* These values have been deduced from the 40-foot groupings given by Mr. Davies in his Table II).

Adopting the customary χ^2 test for the significance of the difference between the observed and expected numbers, for the northern counties the difference is such as would occur by chance seventy times out of a hundred, if the true difference is zero, and is, therefore, clearly not a significant difference ; the implication is that, for this group, the erosion surfaces deduced from the altimetric frequency graphs are, on the basis of statistical theory, untenable. For the southern counties, chance will only explain the difference once in a hundred times and, for this group, therefore, it seems likely that some factor, other than chance, is required to explain the coincidence of peak frequencies in the graphs.

Mr. Davies concludes his analysis by suggesting that the occurrence at certain heights of peak frequencies in the southern counties is matched by peak frequencies, some 20 feet higher, in the northern counties. Using his Table III and lagging the northern frequencies by one 20-foot group the following table may be derived.

TABLE C.—COMPARISON OF MAXIMA IN SOUTHERN AND NORTHERN COUNTIES

Occurrence *Southern*	*Northern*	*Observed*	*Expected*
Peak	Peak	8	5·2
Peak	No peak	8	10·8
No peak	Peak	8	10·8
No peak	No peak	25	22·2
		49	49·0

$\chi^2 = 3{\cdot}32$, for $n = 3$; $P = 0{\cdot}35$.

Here again, the expected numbers have been calculated using a binomial expansion, with $p = \frac{16}{49}$, $q = 1 - p$, and $n = 2$. The value of χ^2 is not significant ; it would occur by chance thirty-five times out of a hundred if the true value is zero—that is, if there is no real difference between observations and expectation. The theory of a parallel pattern of peak frequencies in the southern and northern counties cannot, therefore, be sustained by a statistical argument.

These conclusions are largely of a negative character. In the absence of

https://doi.org/10.1017/S001675680006163X Published online by Cambridge University Press

extensive field studies it is not possible to say whether or not the apparent fruitlessness of Mr. Davies' statistical analysis is borne out by research in the field, but he does remark that he can find little support from field mapping of erosion surfaces in County Down and County Clare.

E. H. THORNTON.

UNIVERSITY OF DUBLIN,
TRINITY COLLEGE,
DUBLIN.

19th May, 1960.

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PETROGRAPHY OF THE MESOZOIC SUCCESSION OF SOUTH WALES

SIR,—In his account of the petrography of the Mesozoic succession of South Wales, Dr. C. B. Crampton (*Geol. Mag.*, 1960, xcvii, 227) concludes that " derivation of material . . . was very local . . . Thus the mineral assemblage at any particular point in the littoral zone was determined largely by the nature of the outcropping rocks of the coastal mainland. This is particularly evident within the Rhaetic sandstones ". The statement is based, in part, on evidence advanced to suggest that garnet appears only in the sandstones near contemporaneous shore-line outcrops of Old Red Sandstone and is contrary to some of my own findings (*Proc. Geol. Assoc.*, 1959, lxx, 158–178) which may not have been published in time for Dr. Crampton's prior consideration.

Among these findings is the recognition of two sandstones separated by black shales. The Lower Sandstone everywhere (even as far west as Pyle, several miles from any possible outcrop of Old Red Sandstone) contains garnet in such abundance as to be almost diagnostic whereas in the Upper Sandstone that mineral is scarce or even absent. The distribution of garnet thus varies with horizon rather than with shore-line outcrop as claimed by Dr. Crampton; indeed his garnet-free Sample 4 (Table I) must be presumed to belong to the Upper Sandstone since I have collected garnetiferous Lower Sandstone in the Cwrt Colman Railway Cutting, only 600 yards to the east of the quoted map reference. Although I have not examined by microscope any samples from Dr. Crampton's other three named localities it seems that the two without garnet (No. 5 and the one from St. Mary Hill) also belong to the Upper Sandstone since the Lower is overlapped thereabouts; the garnetiferous Specimen 3, on the other hand, is part of the How Mill-Herbert's outcrop which I have tentatively correlated with the Lower Sandstone (*op. cit.*, 168).

Nevertheless, there may be local concentrations of minerals as evinced by the titaniferous suite in Sample 4 and in my own record of a " flood " of apatite in the Upper Sandstone at Bridgend, but if the distribution of garnet is any guide, such concentrations could only be proved to be local by widespread sampling of specific horizons within the sandstone concerned. This is rarely possible because of the difficulty of identifying specific horizons. At almost every horizon within the Rhaetic sandstones, moreover, quantitative examination is complicated by the presence of yellow or colourless fossil phosphate which forms part (often a very large part) of the heavy fraction in bromoform separations and which occurs either as sub-angular to sub-rounded grains simulating detrital minerals or as recognizable fragments of fish tooth, scale or bone.