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## II.—ON THE FORMATION OF A SPECIES.

By JOHN FRANCIS WALKER, M.A., F.L.S., F.G.S., etc.

THE object of this communication is to try to give a theory of what takes place when one species is changed into another. When the species A is converted into the species B there must be an intermediate transitional stage in which the collection of individuals is neither the species A nor the species B. I have already defined a species as a centre round which individuals are thickly clustered, and the spaces between these centres may be either devoid of individuals or contain here and there an abnormal form (Davidson's "Suppt. Jurassic Brachiopoda," Pal. Soc., 1876, p. 122).

This idea may be expanded thus:—The true type of a species is its centre, where the individuals are most thickly clustered and most closely resemble each other; those further from the centre differ less or more widely from the type as they approach nearer the boundary of the species.

As a species moves, either in geographical space or geological time, the position of its centre will gradually alter, if its environment be different, so that forms like those contained near the boundary of the species A, and therefore not typical of it, may become the centre of the species B and typical of it. The specimen first figured, the so-called type of a species, may be characteristic of it if it happens to be an individual near the centre of the species, but it is not so if it is a specimen near the boundary of the species; a named figured specimen is only a fixed point.

The so-called species are of unequal value; they may have been named from an abnormal form of growth, or from an immature specimen in which the characters have not been fully developed,

or from one of unusual size, or from a badly preserved specimen in which the characters are obscure. Many of the older species have been made into subgenera, and these again divided into species. The difference between a species and a variety is that the species is more permanent, being in a state of stable equilibrium.

I have stated (Davidson's "Suppt. Jurassic Brachiopoda," p. 180) that it is advisable to give a name to a well-marked variety when it is constantly found in a given geological horizon, although it may be connected by rare forms with other species, and also for the purpose of limiting the extent of variation of a form bearing the same name, so that there can be no doubt which variety is referred to when it is stated to occur in a certain district.

Species can be made to appear to have been joined together by selecting the abnormal forms out of thousands of specimens and neglecting the percentage of normal ones. The abnormal form of one species may be the normal form of another species. The true centre of a species may be found by collecting from a given locality a very large number of specimens and observing the percentage of the different forms. The greatest number of individuals closely resembling each other will indicate the centre of the species at that locality. It will be found that no two individuals are exactly alike, but the amount of variation of those which form the bulk of the collection is infinitesimal; these are the centre of the species, whilst the rarer forms differ from the typical specimens, and are therefore further from the centre of the species. The conversion of one species into another must be gradual, as a sudden change would probably make the species extinct, as it would require time to adapt itself to the conditions which alter its form. Great and sudden alterations in form tend to weaken an individual so that it seldom survives; this serves to check rapid variation.

The tendency of variation in a species is also checked by their interbreeding with each other, and probably the power of variation during a limited time is not great without exhausting the species. The susceptibility to the influence of environment will vary in different individuals: some will be able to alter their form and adapt themselves to the new conditions, others will scarcely be able to alter and will become gradually extinct.

The rate of variation in individuals may be different, and give rise to new species: thus, the species A may develop two or more points nearer its circumference where individuals differing from the typical form begin to thickly cluster, and so give rise to new centres, the percentage of the normal form of the species A becoming gradually less; these centres, if isolated from each other, will give rise to new species. The spaces between different centres of species are unequal, owing to missing species which have not yet been discovered.

The duration of the life of a species will depend on the length of time it exists under the same conditions; the longer it does so the less it will vary, as it will have gradually acquired the most favourable form for its environment, and therefore all variations

will be less favourable and have less chance of surviving. This will account for the greater length of time the Palæozoic species existed compared with the Mesozoic species, as the seas would have greater extent and be less broken up by land.

### III.—ROCK CAVITIES IN GRANITE IN MADAGASCAR.

By the Rev. RICHARD BARON, F.L.S., F.G.S., Tananarive, Madagascar.

I WAS much interested in the account of the 'erosion' of rocks in Corsica given by Mr. Tuckett and Professor Bonney respectively in the January and August numbers of the *GEOLOGICAL MAGAZINE* for 1904, more especially as I have been long acquainted with similar phenomena in Madagascar, and have, equally with the authors mentioned, been long puzzled to find an explanation of their origin at all satisfactory.

Perhaps a brief statement of the occurrences of such rock 'erosion' in the form of cavities as I have met with in Madagascar may be worthy of a place in the Magazine, as being another small contribution to the subject.

I shall first of all give, in very few words, a description of the rock in which the cavities occur, and then proceed to a short account of a few of the most striking of the cavities themselves.

The rock (apparently a boss) in which these cavities occur is porphyritic granite, occupying, roughly speaking, a circular area of, say, fifteen or sixteen miles in diameter, and weathering, as granite usually does, into small and large, more or less rounded or oval-shaped hills, which are scattered all over the surface. The western edge of the mass is some ten or twelve miles to the east of Antananarivo, the capital of the island.

The rock is, strictly speaking, a porphyritic hornblende-granite (i.e. hornblende-biotite-granite). In colour it is grey, blotched, and streaked with black. Fully three-fourths or four-fifths of its bulk is felspar. This occurs in the form of porphyritic crystals, the longest of which attain sometimes two inches in length. The felspar includes orthoclase-microperthite (pure orthoclase is apparently quite absent, or at any rate rare), microcline, and another plagioclase (? oligoclase); these exist in not very unequal proportions. The felspars often show the central accumulation of extremely minute dusty particles, more frequently seen perhaps in more basic rocks (gabbros and norites especially). Micropegmatite, as well as ordinary quartz-felspar mosaic, occurs as a coating round some of the grains. Both the felspar and the quartz (the latter with abundant planes of gas and liquid inclusions) show signs of some amount of molecular strain. The mica is ordinary brown biotite, and the amphibole ordinary green hornblende. These occur in irregular flakes and grains, but are often so intimately associated as to lead to the supposition that the one has been derived from the other.

As accessory minerals, occur sphene (pretty abundant), magnetite (often intergrown with iron pyrites), apatite, zircon, and calcite, possibly also a few minute garnets.