should perhaps forbid us laying much stress on its absence in this particular locality.

On the evidence of the Faringdon *Belemnites*, then, we may conclude that the 'Sponge-gravels' are probably equivalent to the lowermost portion of the Lower Greensand Series of south-eastern England; and I am not aware of any facts adverse to this conclusion either in the other components of the fauna or in the stratigraphical position of the deposit. I hope hereafter to discuss the relations of the Faringdon Beds to other fossiliferous portions of the Lower Greensand of the Midland counties.

VIII.—QUARTZ DYKES NEAR FOXDALE, ISLE OF MAN.¹

By J. LOMAS, A.R.C.S., F.G.S.

IN the neighbourhood of Foxdale, Isle of Man, and especially on Granite Mountain, the ground is strewn with numerous blocks of quartz. Many of them are of large size, 10 feet or more in diameter.

On the slopes of South Barrule similar blocks are found in great profusion, and they can be traced across the hills to the west coast. North of Foxdale other bands are found, some of which are inserted in the geological map. They lie principally in the altered slates of the Barrule Series, and have a general trend corresponding with the main axis of the island, from north-east to south-west. In places they are seen to be *in situ*, and where the granite mass of Foxdale intervenes the general direction changes, and is principally tangential to the intrusion.

Numerous micro-granite dykes extend along the axis of the island in the same direction.

In an old quarry at Renshent on the north margin of the granite several quartz veins are seen to traverse the granite itself. They can be traced along the floor of the quarry and up the vertical face about 30 feet high.

One of these, about 3 feet in width, shows perfectly sharp margins when cutting through the granite, dips at 65° W., and strikes 10° E. of S. It consists mainly of quartz, some clear and some white and opaque, but on entering the granite it changes locally to a pegmatite. The pegmatite contains, in addition to the quartz, large feldspars, some over 3 inches long, perfectly formed, and showing crystal faces, and mica in crystals over an inch in diameter. The granite outside the vein shows the normal features of the medium-grained Foxdale type.

Under the microscope the clear quartz of the vein is seen to consist of one crystal, all parts of the field extinguishing at the same angle. The white opaque parts behave optically in the same manner, but numerous bubbles containing liquid are contained, and these, no doubt, give rise to the opacity. The inclusions are mostly in lines, and sometimes take the form of negative crystals, the principal axes of which are parallel to the cross wires when extinction takes place.

¹ Read before the Liverpool Geological Society, November 11th, 1902.

A little to the east of the quarry is a larger quartz vein about 20 feet wide, which has been worked, and good exposures are visible. The quartz has exactly the same characters as that already described, and the vein can be traced as a feature and by occasional outcrops to Windy Common, above Cloughwilly, a distance of over a mile. Here several cuttings have recently been made, which show the large blocks on the surface to be *in situ*. One of these has proved to be 30 feet wide; it cuts through altered slate containing numerous needles of epidote, and is accompanied on the east side by a micro-granite dyke.

Another cutting further to the west and almost on the summit of the knoll known as Granite Mountain, reveals a vein of quartz, 8 feet wide and dipping 65° E., contained in walls of much altered slate.

At Whallag, under South Barrule, 4 miles south-west of Renshent, the ground is strewn with quartz blocks which lie in great profusion on the moor. Across one of the larger masses a trench has been cut to prove its extent, and it is found to be *in situ*, and forms part of the series of veins which traverse the slates.

A little gully cut by a stream near the Farm Reasch reveals other quartz veins of smaller extent, and a small micro-granite dyke not shown on the geological map.

Dealing first with the Windy Common vein above Cloughwilly, in the cutting it is seen to consist of white opaque quartz with joints running transversely, forming horizontal columns. The joints are more numerous at the margins than in the middle, reminding us of similar features seen in basalt dykes. On the broken faces white mica is often found. Under the microscope it is seen to be indistinguishable from the quartz contained in the pegmatite. The liquid enclosures and negative crystals are perhaps more numerous, but all the quartz of the slide is orientated in the same direction, and extinction takes place in all parts at once. In this rock there is no sign of shearing.

The 8 ft. dyke on the summit of Granite Mountain differs only from the one just described in exhibiting traces of incipient shearing. There has been no displacement, but cracks divide the crystal into lenticular areas, leaving the whole in optical continuity. The lines of bubbles are quite independent of the cracks.

At Whallag almost exactly the same features occur, and fragments of altered slate up to 5 or 6 inches in diameter are sometimes included in the quartz.

Further to the south-west, and in the same general direction, the slates of the coast, as at Fleshwick Bay, contain quartz bands. They are folded and twisted with the slates, and often separated into lenticular bands. A slice from one of these bands shows under the microscope quartz of exactly the same character as those described, but shearing has gone on to such an extent that actual displacement has taken place.

Along the lines of movement a fine quartz mosaic has been formed, but the units which have moved are simple crystals.

Under crossed nicols the mosaic is seen to consist of areas of uniform extinction, and the included bubbles bear no relation to the lines of shear.

We are here forced to conclude that the parts have once been continuous, that the liquid inclusions are original features, and that they are portions of veins which have been disconnected by earth movements.

If the quartz, when traversing the granite, is of igneous origin, and the formation locally of a pegmatite is proof on this point, we cannot deny a similar origin to the quartz occurring as veins in physical continuity with that in the granite.

There is *a priori* no reason why quartz should not exist as an igneous rock. Given a magma with a limited amount of bases, combinations would go on until the silica had united with all the bases available, and then a residuum would be left which on consolidation would be pure quartz.

A comparison might be made of these veins with the Pfahl of Bohemia, where quartz occurs as veins through the granite and mica-schists, extending in unbroken sheets over a distance of 55 kilometers. Gümbel, however, has shown that the Pfahl is associated with displacement, and he regards the quartz as filling up cracks after faulting. In the Isle of Man, I am inclined to look upon the veins as true igneous dykes, running parallel to the micro-granite intrusions, and only differing from them in their exceptional composition.

IX.—THE TERM 'HEMERA.'

By A. J. JUKES-BROWNE, B.A., F.G.S.

IN the December number of this Magazine Mr. Buckman complains that the use of his term *hemera* has been widely misunderstood. He says that it was never intended to be used for a subdivision of a zone, but solely as a chronological term to indicate the time during which the beds composing a zone were deposited, just as the term *age* is now generally accepted in a technical sense to mean the time during which a stage was deposited.

As one of those who must plead guilty to having misunderstood Mr. Buckman, I should like to explain how it is that he seems to have laid himself open to misapprehension. To put it briefly, Mr. Buckman, in his original paper of 1893, used the term *hemera*, not merely as a chronological term (though he defined it as such), but also as serving to represent a subdivision of a zone; for in two of his tables he used it as a stratigraphical division, and consequently it is his own fault if others supposed he meant it to be used in a stratigraphical sense, in spite of his own words about its chronological meaning.

That this was the immediate effect of his paper is proved by the report of the discussion upon it, in which the President spoke of "subzones or emata,"¹ and Mr. Winwood protested against the proposed term, saying that "if Mr. Buckman found it necessary to

¹ The word originally suggested was *emar*, subsequently altered to *hemera*.