described a great natural dam across the valley of the Great Valley Creek, near Peth, where the moraine stretches across the valley from side to side; and he spoke of the contrast between the numerous drainage valleys which drained the waters of the melting ice into the Allegheny River, and those valleys which took their rise south of the moraine, and were free from all drift.

After giving some details of the western lobe of the ice-sheet, and dwelling upon the agricultural significance of the moraine, he spoke of some curious deposits of glaciated material which occurred in a narrow strip of ground immediately in front of the moraine, and which he had named the 'fringe.' These deposits consisted of bowlders of Canadian granite, and other rocks, which he found perched upon the summits of hills, sometimes as far as five miles in front of the moraine, though never farther. This glacial 'fringe,' confined to the western part of the state, was found to increase in width from two miles in Warren county to five miles on the Ohio line, and was at first a puzzling phenomenon. The hypothesis suggested was, that, like breakers on the seashore, the top of the ice overreached the lowest strata by the width of the 'fringe,' and that while the moraine marked the halting-place of the bottom of the ice, by which it was formed, the far-transported bowlders were carried on more rapidly in the top strata of the ice, and were dropped outside of the moraine to form the 'fringe.' It was stated that the striae in the western part of the state all pointed south-east, being at right angles to those in the eastern part of the state, but, like them, pointing always towards the moraine.

In conclusion, the author reviewed the more important facts discovered during his exploration of the line of the moraine, dwelling upon the character of the moraine where crossing river-valleys, the absence of proof of any tongues of ice down such valleys, the absence of glacial drift south of the moraine, the very slight erosion caused by the passage of the glacier, and especially upon the deflections, large and small, in the line of the moraine, which were inexplicable on any other hypothesis than that the moraine now described was pushed out at the foot of a continuous ice-sheet of immense extent.

LETTERS TO THE EDITOR.

Change of birds' notes.

FOR some years it has been known to many about here, that in one locality the cardinal bird (Cardinalis virginianus) has been in the habit of imitating the notes of the whippoorwill (Antrostomus vociferus). From articles I have read from time to time in various scientific journals, I infer that it is not generally known that birds ever, in the wild state (especially cardinalis), change their song. I therefore thought it well to report this case. I have in several instances known this bird to change its song, under confinement, for one entirely different; but this is the only case I have ever known where such a thing has occurred in the wild state. I have known of this case for about ten years.

F. O. JACOBS.

Newark, Licking county, O.

St. David's rocks and universal law.

The article with the above heading in SCIENCE of June 15, by Dr. M. E. Wadsworth, has just come under my observation; and, as it refers to questions which have arisen chiefly in consequence of my researches among those rocks, I shall deem it a favor if you will allow me space in SCIENCE for a few remarks in explanation. Professor Geikie's paper was written with, as he states, 'a sense of duty' to 'defend the views of his predecessors;' and it is perfectly certain, from the hasty manner in which the work was gone over by Professor Geikie and his two assistants, that the object was to vindicate the work of the Geological survey of thirty or forty years ago, rather than to apply the knowledge gained by the work of many independent observers since that time to correct the errors well known to have been committed by the surveyors, which remain as blots on the maps even now issued by the Geological survey. In the district of St. David's, these maps show a great intrusive mass passing under the city of St. David's, about eight miles in length, and with an average width of about a mile. The southern portion is called syenite, and the other felstone. The rocks lying along the north-western edge for about a mile in width are colored as altered Cambrian, presumably as the result of the intrusion; but on the south-east the rocks of the same age are supposed to be in contact with the mass in an unaltered condition, and without even a line of fault to separate them. These appearances were curiously anomalous if true: hence I felt it necessary to go very carefully into the question. My large acquaintance with the district, and the knowledge I had obtained in my explorations among the lower fossiliferous rocks of the area, enabled me to do this with some advantage. I had also, from time to time, much valuable assistance from Professors Harkness, Hughes, and Bonney, and from Mr. T. Davies of the British museum, Mr. Tawney, etc.

I found that under the same name, rocks of very different characters had been grouped together. The so-called syenite ridge was seen to consist in part of granitoid rocks, but also of quartz-felsites, of hälleflintas, of breccias, and of porcellanites freely traversed by intrusive dikes of various kinds. The so-called metamorphic Cambrian on the north-west was soon discovered to be an entirely distinct series from any Cambrian rocks known in the district, or, indeed, anywhere in Wales, and to be largely made up of volcanic rocks; and the basal Cambrian conglomerate, as marked on the survey-maps, was shown to overlie the granitoid, the quartz-felsite, hälleflinta, and the volcanic schistose and brecciated series unconformably, and to be mainly made up of fragments derived from those series. From the examination of the conglomerates also, it was seen that there were distinct evidences of their having been deposited along old coast-lines, and that their materials varied with the rocks upon which they reposed; also that these pre-Cambrian rocks must have been much in the condition in which they are now found, before the Cambrian conglomerates were deposited upon them. Curiously, also, I found that many of the masses colored as intrusive greenstones on the survey-maps were highly *acid* rocks, and others indurated volcanic ashes of pre-Cambrian age. Indeed, nearly all the so-called intrusive masses marked so abundantly on the survey-map among the older rocks in the St. David's area have been proved beyond doubt to be the result of erroneous observation; and yet we are told by the present director-general that little or no change is required in these maps, and that he