of his researches and of that of his predecessors is the record of this branch of the museums, and also of the debt which knowledge owes, and must ever owe, to the influence of one of he most remarkable of the pioneer laboratories and great European centres of scientific work.

JOHN BUTLER BURKE.

THE "NATURE-STUDY" OF BIRDS.[1]

THIS book fulfils the chief conditions we have previously insisted upon as being essential in all new works relating to the birds of the British Isles, in that it is original, interesting, exquisitely illustrated from living subjects, and not burdened with technical names. Indeed, the latter are conspicuous by their complete absence, thereby, no doubt, rendering the volume much more acceptable to readers of all classes than it would have been had it included the usual superfluous intercalations in bracketed italics. Mr. Boraston, it appears, took to the "nature-study" of birds comparatively late in life, and in his case it may be truly said "better late than never," for had he never done so lovers of nature in general, and of birds in particular, would have been deprived of a very charming volume containing a number of fresh ideas and suggestive observations. Having once decided to take up the outdoor study of bird-life, the author entered on his task with characteristic energy, and at once saw how essential it was for him to follow in the steps of the Messrs. Kearton and to employ the camera to perpetuate the scenes that he so much enjoyed if his work was to be one that would appeal successfully to the public.

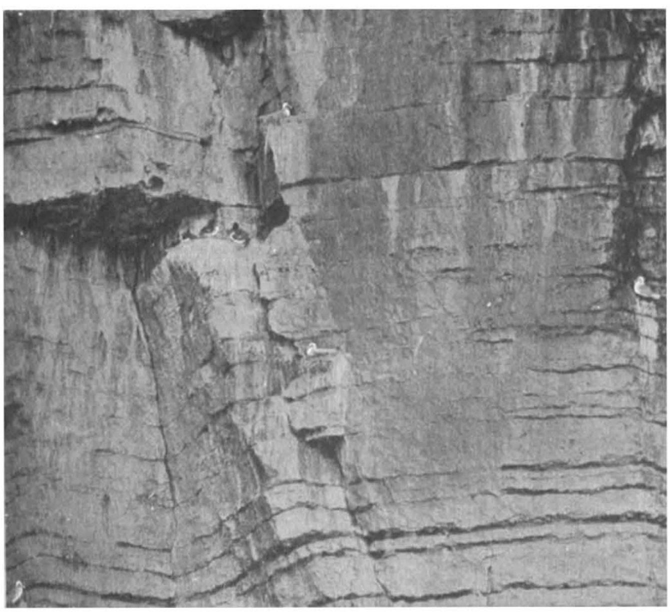

FIG. 1.—Kittiwakes on an Anglesea Cliff. From "Birds by Land and Sea."

How successful have been the results, both from the literary and the artistic point of view, readers of his book will not, we venture to think, be long in deciding. To whet their appetites, we herewith reproduce a couple of the illustrations, all of which, by the way, are taken from the author's own photographs.

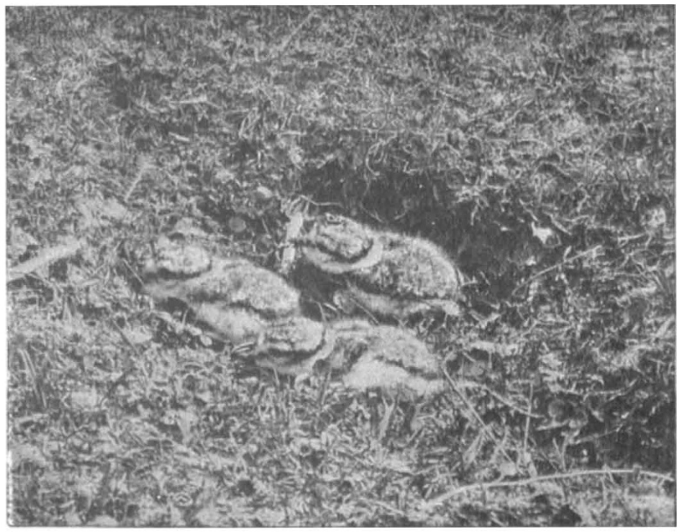

FIG. 2.—Young Ringed Plovers crouching. From "Birds by Land and Sea."

The volume opens with the latter of what the author terms the two critical periods of bird-life, namely, March and September, when the migratory species are in the thick of their departure from or arrival at the British Islands. From September until May the seasonal observations of the year forming the subject of the volume relate to the bird-life of the neighbourhood of the author's home at Stretford, near Manchester, but during June the scene is transferred to the wild coast of Anglesea and Puffin Island, while in July and August we once more return to the home district. Perhaps the Anglesea interlude forms the most interesting part of the volume; but whether on a holiday or whether at home, the author seems to be endowed with a marvellous capacity for work, both in the matter of making and recording observations and in taking photographs.

On the wild cliffs of Anglesea, as we are told on p. 210, "stalking" birds for the purpose of taking their portraits by a well planned snap-shot demands a considerable amount of coolness and steadiness on the part of the observer, as if he becomes too much absorbed in the object of his pursuit awkward accidents are likely to occur; and even if such undesirable contingencies are successfully avoided, disappointments from unsuspected or unavoidable causes are only too likely in many instances to annul the results of all the toil and trouble. Who, for instance, will fail to commiserate the author on having lost the chance of "snapping" a sitting nightjar (p. 202), from the fact that he actually did not see the bird for some seconds, and then, when "his eyes were opened," the camera slipped?

[1] "Birds by Land and Sea; the Record of a Year's Work with Field glass and Camera." By J. M. Boraston. Pp. xiv+282; illustrated. (London: John Lane, 1905.) Price 10s. 6d. net.

As an example of the successful accomplishment of a difficult task, we reproduce (Fig. 1) the photograph of kittiwake gulls nesting on the precipitous face of a cliff, approach to which was effected by climbing down a narrow gulley and then scrambling over seaweed-clad boulders, to the imminent peril of the camera.

As a specimen of really excellent bird-photography, we present to our readers the picture of a group of young ringed plovers (Fig. 2), the mottled down of which harmonises so admirably at a short distance with their surroundings.

If it be said that this notice is purely commendatory, and contains nothing in the way of criticism, the reply is that we have found nothing to criticise or to condemn. It is real nature-study. R. L.

THE ARTIFICIAL PRODUCTION OF RUBIES BY FUSION.[1]

THIS memoir opens with a short historical account of the attempts previously made to produce rubies by fusion, starting with the researches undertaken by Gaudin with the view of obtaining fused alumina in a transparent state. He obtained by fusing potassium or ammonium alum, together with a little chrome alum, small globules, which became opaque on solidification, but had the composition of the ruby. These were shown by Becquerel to have the cleavage of corundum, and contained small cavities lined with crystals of ruby. Gaudin concluded that alumina could not exist in the vitreous state, and this view was supported by C. Sainte-Claire Deville, on account of the uniform density of the oxide before and after fusion. The facts at present known are in support of this view, for the transparent alumina obtained by fusion is a completely crystalline mass. The problem was not further investigated until, in 1886, Charles Friedel described an experiment by which corundum was obtained by fusion, presenting most of the properties of the ruby, but differing from the natural product by the presence of certain included bubbles, and by a rather low density.

As the production of the so-called "Geneva rubies" remained a trade secret, M. Verneuil started a series of investigations, following up the work of Gaudin. He found that to obtain the fused material in a transparent state certain conditions must be rigorously fulfilled. He compares the solidification of alumina to that of water, which forms according to the method of cooling transparent or opaque ice. An important observation which appears to have escaped Gaudin is that it is only the portions of alumina which are fused in the cooler parts of the flame which remain transparent on solidification. One of the greatest experimental difficulties is that, however carefully the cooling is conducted, the fused mass is excessively brittle. This brittleness is least marked when a very small supporting surface is employed. The apparatus devised by M. Verneuil is very ingenious. The blow-pipe and furnace tube must be absolutely vertical. The finely powdered alumina, containing the requisite quantity of chromic oxide, and specially purified, is admitted by means of a fine sieve, which is given a series of regular taps, controlled by an electromagnet, so that the material falls down the tube intermittently in a series of thin layers. It forms a cone at the bottom, and as soon as this cone reaches a hot enough part of the tube the apex fuses, and the fused material then extends gradually upwards in a long filament. This eventually reaches a still hotter part of the furnace, and develops a spherical mass instead of growing further; this spherical globule when solidified forms the ruby. The cooling has to be very gradual, so that the crystalline particles have time to become regularly arranged, or an opaque product is obtained. If the ovoid mass is carefully detached when cold, it splits up into two nearly equal portions, but not along a cleavage-plane. The product so obtained is an individual crystal, and the direction of its principal optic axis is never very different from that of the major axis of the ovoid.

The product when cut cannot be distinguished by its chemical, physical, or optical properties from a stone cut from a natural ruby. The operation may be considered successful when the clear product weighs 12 to 15 carats, and has a real diameter of 5 or 6 millimetres. It is, however, impossible to obtain stones larger than ¼ carat free from included bubbles and cracks, and experts can therefore readily distinguish the artificial gems from natural ones. These flaws do not in any way detract from the beauty of the stones; they are often clearer than many natural rubies, which are seldom found perfect.

The paper is illustrated by diagrams of the very ingenious apparatus devised by the author.

[1] "Memoire sur la Reproduction artificielle du Rubis par Fusion." By A. Verneuil. (*Annales de Chimie et de Physique*, 8e série, t. ii., September.)

CALCIUM METAL.

ELECTROMETALLURGY has at last succeeded in producing metallic calcium in commercial quantities, and at what must be considered a relatively low price. Until within a few weeks ago this metal had only been available in very small amounts, and remained a rare laboratory specimen; it is now obtainable at a price per kilogram less than that charged by most chemical dealers for a small one-gram sample. Humphry Davy first formed the amalgam by electrolysing lime, mixed with mercuric oxide and slightly moistened, with a mercury kathode; he isolated the metal in small quantities by distilling off the mercury. Since then many chemists have tried in vain to find a method suitable for its preparation on a larger scale. Matthiesen, making use of Bunsen's suggestion of applying high current density at the kathode, only succeeded in obtaining a few grams at a time by electrolysis of the fused chloride, or of mixtures of calcium and other chlorides having a lower fusing point. Henri Moissan, as the result of a critical study of the numerous proposed methods, was able to prepare somewhat larger quantities of the metal. His method was essentially a modification of that proposed by Liès-Bodart and Jobin in 1858, which consisted in reducing fused calcium iodide with metallic sodium. Moissan found that molten sodium forms an excellent solvent for calcium, and by heating calcium iodide with a large excess of sodium obtained on cooling a cake of the sodium-calcium alloy resting on the sodium iodide. Small quantities of the alloy were thrown into well cooled absolute alcohol, which reacts with the sodium leaving the calcium pure, but in the state of a fine crystalline powder. This powder can be agglomerated by pressure and fusion, and thus Moissan prepared the fine specimen ingots of this metal which so greatly interested visitors to the Paris Exhibition of 1900. It is largely to him that we are indebted for a knowledge of the properties of the pure metal, of which he prepared some 4 kilos. by this process. Contrary to the earlier descriptions, calcium is a white metal, the yellow coloration being due to a film of nitride; its melting point is about 760° C., and its density 1.85. The definite compounds which it forms directly with hydrogen and nitrogen promise useful applications in the laboratory in cases where it is necessary to remove these gases.

The next advance was made almost simultaneously by Borchers and Stockem at Aix-la-Chapelle, and