NOTES ON THE FORMATION OF THE IRON ORES.[1]

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AMONG the deposits of iron ores in Missouri, those of specular hematite in the sandstones of the Ozark region, although not so well known as the porphyry ores, are an important and extremely interesting class. These deposits are found in caves in the Ozark series of limestones and sandstones, heretofore considered of Lower Silurian age, and the equivalent of the Calciferous sandrock of New York State. From recent investigations of the Missouri Geological Survey, there is reason to believe that these rocks are of Cambrian age.

At Cherry Valley, in Crawford County, there is a large deposit of specular hematite of this class. It occupies a depression in the strata formed by erosion and undermining. The ore is a good one for foundry purposes, and is smelted at the Midland Furnace, about six miles distant from the bank. The ore in the upper portion of the bank is harder and more silicious than that found deeper. It carries silica in the form of amorphous yellow jasper and also as quartz. The quartz is found in very perfect, singly terminated crystals, both colorless and amethystine, and of a dark, smoky color, the latter being due to included crystals and fragments of hematite. Specimens are in the Survey collection of perfect crystals of amethystine quartz, studded with crystals of specular hematite and frosted with minute acicular crystals of goethite of a beautiful golden-brown color. The ore has many vugs or cavities, which are lined completely with crystals of hematite, magnificently colored — red, golden-brown, peacock-blue, green, etc. While examining a number of these specimens lately, the writer's attention was drawn to the peculiar appearance of one, the markings of which had a great resemblance to the stem of a crinoid, while in another part of the same specimen there was a somewhat indistinct impression of a stem and cup of a crinoid. The specimen in question was submitted to Professor Van Hise of Madison, Wis., and by him to Dr. Birge, professor of zoölogy in the Wisconsin State University. These gentlemen say that there is not the least doubt in their minds of the organic origin of the peculiar markings of this specimen. Since then one more specimen of like nature has been found.

These organic remains, occurring in the deposit of specular ore just described, have a significance perhaps not wholly seen at first glance. They indicate that certainly a portion of the ore in these deposits has been formed by direct replacement, molecule by molecule of limestone by the iron from ferruginous waters. They also suggest that the chert, which is so abundant in these limestones, was the source of the silica in the ores. It is thus very probable that the iron was originally substituted as carbonate and subsequently concentrated and oxidized. The following terse statement by Professor Van Hise in regard to the deposit formed in a peculiar manner in Wisconsin is applicable here:[2] "The chemistry of the process assumes the following: that the oxygen of the percolating waters is sufficient to oxidize iron carbonate not in solution, and set carbon dioxide free; that the resulted carbonated waters are sufficient to take iron carbonate in solution; that if such waters bearing dissolved carbonate are mingled with waters bearing oxygen, the iron carbonate, or a portion of it, will be precipitated; that silica may be carried in percolating waters; that a carbon dioxide solution sufficient to precipitate silica by dilution may be made so weak in carbon dioxide that it would be capable of taking silica into solution. All of these facts and principles of chemistry are so well known that no discussion of them or reference to authority is needed."

One more question affected by these specimens is that of their age. While the fossil forms are too indistinct to identify the species, they are undoubtedly of Lower Carboniferous age. This suggests the idea that Lower Carboniferous rocks extended at least to this distance over the central portion of Missouri, and further that these deposits of iron ore had at least not ceased forming until after this period. These ore deposits, as stated before, are found in Cambrian rocks, but the precise period of their formation cannot be determined from our present knowledge of the facts in the case. So far, but one deposit of Lower Carboniferous rocks has been found in place anywhere near here, and that is a very small one. The writer has found fragments of chert with Burlington fossils on the hills some thirty miles west of here, but, with these exceptions, knows of no deposits of these rocks nearer than St. Louis County.

It is evident, therefore, that erosion has played an important part in removing the mantle of Lower Carboniferous rock, and it is probable that this agency at the same time prepared the underlying Cambrian rocks for the reception of the iron ores.

It is not within the scope of this article, however, to demonstrate the questions of the origin and age of these deposits, but merely to record the occurrence of these organic forms and to suggest their probable meaning. These questions are treated in a much fuller manner by Mr. Frank L. Nason, in the recently issued report of the State Geological Survey, on the Iron Ores of Missouri.

[1] Published with the approval of Arthur Winslow, State Geologist of Missouri.

[2] Am. Jour. Sci. (III), vol. xxxvii., p. 43.

NOTES AND NEWS.

AN important meeting of the Victoria Institute, London, England, took place last month, when Mr. J. W. Slater, F.C.S., F.E S., read a paper in which he traced the difference between life and the physical forces, and reviewed all those experiments and arguments by which some had sought to prove that a key to the origin of life had been obtained. Contributions to the discussion of the question were made by Sir George Stokes, Bart., V.P.R.S., who stated that Lord Kelvin's recently alluded to suggestion that the germs of life on this earth might have come from the bursting of a remote star, was only intended by him to refer to the possible transmission from one part of the universe to another of life germs, but that the first origin of life itself we must all refer to God. Professor Lionel Beale, F.R.S., in supporting Mr. Slater's views, said that an absolute line must be drawn between the living and the non-living. Living matter was distinguished from all other matter by a property, power, or agency, by which its elements were arranged, directed, and prepared to combine according to a pre-arranged plan for a definite purpose. There was no gradual transition from the non-living to the living. Life was a special position independent of and not in any way related to the physical forces, it had nothing in common with any material forces, powers, or properties, and holding in the cosmos a remarkable and peculiar place. Professor Bernard of Dublin pointed out that all evidence went to show that vital forces are unique and not comparable with any other forms of energy. Dr. Rae, F.R.S., contributed some valuable remarks, as also did Dr. Biddle, the Revs. R. Collins, M.A., J. H. Clarke, and W. A. Pippet. Dr. F. Warner, M.D., F.R.C.P., made several valuable remarks on the question, which was also spoken on by Dr. Shettle of Reading, Dr. Schofield, and others. Dr. Schofield was very interesting in those remarks in which he pointed out what may be called the history of the controversy in regard to life and the physical forces, and in concluding he specially referred to the dictum of Professor Huxley, viz., "Life existed before organism and is its cause." What that cause was the Christian philosopher fully recognized.

— J. B. Lippincott Company announce for immediate publication a new (third) edition of the "Life of Benjamin Franklin," edited from original manuscripts and from his printed correspondence and other writings, by Hon. John Bigelow. Since the appearance of the previous editions the author has been able to secure considerable new and important information never before published, which is incorporated in the new work. This edition also contains several additional interesting illustrations. The work is bound in three volumes, as heretofore. A new edition of "Our Own Birds" has just been issued by J. B. Lippincott Company. The volume contains a natural history of the birds of the United States, revised and edited by Edward J. Cope, Corresponding Secretary of the Academy of Natural Sciences, Philadelphia. Although the first edition was profusely illustrated, twelve new half-tone plates have been introduced, which greatly add to the value of this edition.