

## PREFACE

THE publication of this *Atlas*, in accordance with the desires of Professor Barnard, was assured by a grant made by the Carnegie Institution of Washington in 1907. The long delay in its appearance calls for an explanation. Mr. Barnard was in the throes of preparing for publication a volume of his pioneer celestial photographs made at the Lick Observatory in the years 1889-1895. He had difficulty in satisfying himself that any mode of reproduction could adequately depict the qualities of the original photographs.

That handsome work, which forms Volume XI of the *Publications of the Lick Observatory*, was not printed until 1913. It was natural and proper that the preparation of the present volume should have been delayed while the task of completing the earlier volume was in hand. The mode of reproduction to be adopted for the splendid photographs of this *Atlas* had not been selected at the time the original grant was made, and consequently considerable investigation and experiment were necessary in reaching a decision on this important matter. The attempts made with the photogravure and other processes did not give the assurance of uniformity that was desired, and finally the author was persuaded that actual photographic prints would be more satisfactory and hardly more expensive than any other available method of reproduction. After this decision had been reached and had been approved by the Carnegie Institution of Washington, Professor Barnard began the task of making the reproducing negatives, and then took upon himself the heavy duty of personally inspecting every print of the 35,700 needed in the issue of an edition of 700 copies. He made frequent trips to Chicago during the years 1915, 1916, and 1917 for this purpose and spared no pains to assure himself that the prints were uniform in quality and faithfully represented the originals.

The printed descriptions were written by him after a most careful study of the prints as well as of the original negatives. Professor Barnard's well-known eagerness to observe the heavens whenever the sky was clear left him little time for the remainder of the preparation of the work for publication. The reduction and publication of current observations had, with him, the right of way, and therefore it was not until late in 1922 that the first draft of the descriptions of the photographs was ready. Unfortunately, the form of publication of the whole of the *Atlas* had not been settled up to the time of Mr. Barnard's death, although we had had many discussions upon the subject. It had been decided that, in addition to the photographs, there should be given

pen-and-ink sketches of the fields, with a system of co-ordinates by which the positions of all distinctive markings and other objects of interest could be readily noted. The form of the tables, giving further details of objects designated on the charts, had been arranged for the most part by Professor Barnard. The plan of issuing the work in two parts, so that the student of the *Atlas* can simultaneously have before him the photograph, its description, the key charts, and the tabular data of the objects designated, has been adopted after Mr. Barnard's death, but I believe that it would have had his approval.

In the case of the text descriptive of the photographs, the wording which Professor Barnard used has been preserved as closely as possible. Square brackets have been occasionally placed about sentences or paragraphs for which responsibility could not be assigned to the author. He left many scattered notes intended for the Introduction. These have been utilized as far as possible in carrying out the author's intention. His notes and comments were written down at times within a period of nearly a decade, during which his own views were changing and becoming more definite in certain directions. For example, when the *Atlas* was first planned, Professor Barnard certainly did not entertain the view that the dark markings could be anything else than vacancies in the sky. But his minute study of his many photographs gradually convinced him of the correctness of the views advanced by some other astronomers that these were dark or faintly luminous objects. The reader may easily detect the course of this changing opinion, although it could not always be brought out in its proper chronological sequence.

The increasing interest in these dark objects, as their nature has thus come to be better understood, has seemed an adequate reason for including in Part I "The Barnard Catalogue of Dark Objects," now reaching the number of 349. These will probably be designated most conveniently in the future by their numbers in this catalogue, as B 170 or B 250, etc. Hundreds more of them will doubtless be located and described on these photographs or on others by future investigators.

The title assigned in 1907 to this work was *An Atlas of the Milky Way*. It was not until much later that the final choice of areas to be included was made by Professor Barnard. That title implied that at least a large part of the Milky Way was included. This would have required from three to four times the number of photographs for which provision could be made. Accordingly, it seemed to me best, after the

printing was begun, that the title should be changed to its present form, which correctly indicates that the *Atlas* deals with selected areas of the Galaxy and that it does not attempt to include more. The diagram on page 14 of the Introduction will give a proper idea of the distribution of the plates over the Galaxy.

During the years of work on the *Atlas*, Mr. Barnard wrote several of his most important articles on the Milky Way for appearance in the *Astrophysical Journal*. The following may be especially cited: "Dark Regions in the Sky Suggesting an Obscuration of Light," *Astrophysical Journal*, **38**, 496–501, 1913; "A Great Nebulous Region Near Omicron Persei," *ibid.*, **41**, 253–258, 1915; "Some of the Dark Markings in the Sky and What They Suggest," *ibid.*, **43**, 1–8, 1916; "On the Dark Markings of the Sky with a Catalogue of 182 Such Objects," *ibid.*, **49**, 1–23, 1919.

It was the author's expressed intention to use freely in his Introduction extracts from these papers, since, as he said, they correctly express the opinions held by him at the time of the conclusion of his work on the *Atlas*. Limitation of space has not permitted the inclusion of many such extracts, and the reader is therefore advised to consult these papers in his use of the *Atlas*. Attention is called to the bibliography of Professor Barnard's principal papers in the field of celestial photography, printed on pages 15–17 of the Introduction.

The writer could hardly have undertaken the responsibility of completing this unfinished work upon the death of Mr. Barnard, had it not been possible for the Observatory to retain the services of Miss Calvert, who, as Mr. Barnard's personal assistant, had been associated with the undertaking from its beginning. She had assisted the author in laying out a system of co-ordinates on the key charts, which she sketched under his personal supervision. She also began with him the preparation of the tables of objects noted on the charts, and later completed these, besides checking, with meticulous care, all numerical data for both parts of the *Atlas*. She also completed the supplementary list of dark objects begun by Mr. Barnard, determined their positions, and assigned them their numbers. I hereby express to her my appreciation of her large share in the editorial duties.

I wish also to thank the officials of the Carnegie Institution of Washington for their patience in waiting for so many years for the publication of this work and for the generosity with which they have supported it. I desire also to acknowledge my appreciation of the care and attention which has been given to this publication by the University of Chicago Press, and in particular by Mr. A. C. McFarland, manager of its Manufacturing Department. An acknowledgment of the fine service rendered by the photographers, Messrs. Copelin, has been given on page 13.

To all astronomers and most of the amateurs of the present generation, the remarkable observational achievements of Edward Emerson Barnard are familiar. Since this *Atlas* may come into the hands of some who have had little acquaintance with the development of astronomical photography it may be appropriate to say a few words regarding the career of Mr. Barnard to whom this *Atlas* may be considered in some sense a memorial volume.

Born at Nashville, Tennessee, on December 16, 1857, he had little opportunity for education, owing to poverty. The mystery of the starry heavens caught his attention as a lad, and almost his first purchase beyond actual necessities was a telescope with which he might penetrate farther into the illusive study of the details of the nocturnal sky. As a small boy and until young manhood, he supported himself by working at Nashville in a photographic establishment in which he learned all the details of the art, an invaluable preparation for the future application of this knowledge to the celestial field. He discovered many comets, nebulae, and other objects of interest, with his small visual telescope, and later took courses at Vanderbilt University. He made such a name for himself that he was called to be an astronomer on the staff of the Lick Observatory at its inauguration in 1888. This brilliant period of discovery and observation continued until 1895 when he came to the University of Chicago to be an astronomer at the Yerkes Observatory. Here he labored with extraordinary assiduity and with distinguished success, from the opening of the Observatory in 1897 until ill health put an end to his observations at the close of 1922.

EDWIN B. FROST  
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