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Dr. GOULD and has been loyally followed by Dr. THOME. These gentlemen have been faithfully assisted by many observers, usually North Americans.

Science has no country and the priceless results which have been attained belong to the whole world. Yet it is permissible to rejoice that it is to American astronomers, GILLISS, GOULD, THOME and their assistants, that many of the chief advances in our recent knowledge of the stars of the southern sky are due; and this much can be said while giving the fullest credit to the labors of other astronomers in the southern hemisphere.

The preface written by Dr. THOME follows, and I hope that the work of which it treats will be even better appreciated because of this slight introductory note which I have written.

EDWARD S. HOLDEN.

*Preface to Volume XIII of the Cordoba Observatory Publications.*

By J. M. THOME, Director.

“With the present volume, the publication of the separate determinations made in the years 1872-1880 is completed, and they are now embodied in permanent form, secure against all temporal vicissitudes. This labor has been carried on uninterruptedly for the past six years, during which period seven volumes have appeared. The time and labor required in the revision have been very great, no pains having been spared to secure accuracy in every case of doubt, and I now have reason to believe that, after making the corrections indicated in the lists of errata accompanying each publication, the entire series of fourteen volumes will be found nearly perfect.

It is for me a source of sincere congratulation that I have been able to perform this service. These results were obtained only after many years of rude labor, unflinching energy and vigilance, and it was due that they should be published with loving care. Having been associated with the Observatory from the beginning, occupying the nominal Directorship during the progress of these observations for periods amounting to more than two years, and having contributed a larger part to the formation of these Catalogues than any other assistant, there was no one, probably, who could have so intimate a knowledge of the requirements for their proper publication after Dr. GOULD, to whom they owe their origin.

Meanwhile, the regular programme of observations has been continued uninterruptedly with good results, in spite of many vexatious and disheartening occurrences and malicious combinations. The chief object has been the extension of the Southern Durchmusterung from the limit to which it had been carried by the lamented Dr. SCHÖNFELD. This we have succeeded in doing as far as to the parallel of  $42^\circ$ , and we have made in that region ( $22^\circ$  to  $42^\circ$ ) more than a million observations, representing over 300,000 positions and magnitudes of stars and nebulae to the 10.0 magnitude inclusive. These observations were begun at the end of the year 1885, and the first installment of Results has been given to the printer. We have, besides, obtained something more than 30,000 determinations of stellar positions upon the meridian, a large series of observations of comets and of the minor planets, numerous latitude and longitude determinations, and some fine long-exposure photographs with the new telescope by WARNER & SWASEY.

It is a grateful pleasure to acknowledge here to the illustrious men of science of every nation the generous aid and the unvarying interest shown by the National Government in the affairs of the observatory during the momentous occurrences of the past few years and the actual crisis of the present. In spite of the clouds that hang over this noble and generous people now, the Nation is destined to emerge triumphant, in a few years, and to again assume the leadership, morally and physically, among the Governments of South America.

My especial thanks are also due to the distinguished astronomers Dr. AUWERS, of Berlin, Dr. GILL, of the Royal Observatory of the Cape of Good Hope, and to my venerated chief, Dr. GOULD, for their generous encouragement and advice.

The present volume contains the observations made during the year 1880 for the General Catalogue. The number of separate determinations was 33,837, giving the mean places of 10,923 stars. For all of these, four microscopes and eleven transit threads were employed, except for the time stars, in which case seventeen transits were recorded.

The dimensions of the volume almost entitle it to the rank of a General Catalogue, and the results for the month of December, alone, when 5938 determinations of positions were made, would

form a fair Annual Catalogue.\* A few words of explanation may be necessary.

About the middle of the month of July, 1880, when one-third of the total number of observations for the year had been made, Dr. GOULD was called away for the remainder of the year upon a special mission, and the temporary Directorship was assigned to me. As this was to be the last year of special observing for the General Catalogue, the desire to signalize the event by an extraordinary effort that should produce the maximum result compatible with exactness, grew into a purpose with me, and a method was tentatively elaborated and perfected which gave the result mentioned above, without being in the least degree irksome to any of the participants, since they all accepted the idea with eagerness.

It seems rather extraordinary now, after this accumulated weight of years, but it was pure enthusiasm with all of us then, free from any taint of vainglory or disregard of the rigorous requirements of orthodox observing. The idea simply was to demonstrate what four carefully trained specialists in this kind of work, acting in perfect accord, could accomplish with our Meridian Circle in a given time.

The programme required the presence of three men in the circle room: The observer, who reclined in a comfortable position upon the chair throughout the observations; the microscope reader, who also made the pointings of the telescope; and the recorder, temporary chief of the party, who was seated at a small desk before the dial, and whose duty it was to give out the settings from the programme, record the readings of the microscopes, take their means, and give such information to the observer as was needed to identify the star.

In this arrangement, the greatest physical strain fell upon the one at the microscopes, and consequently the recorder exchanged places with him at intervals of an hour and a half. When the night was a long one (eight hours), the observer for the second half came at midnight, and thereafter the first observer would alternate with the recorder and microscope reader. Each observer began and ended with a time star, and observed others at

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\* As a means of comparison, the catalogue of the Royal Observatory of the Cape of Good Hope, which contains 40,000 observations of 12,441 stars may be taken. This was observed by Mr. STONE with the aid of four assistants, in eight years (1870-78), and was the most notable production up to that time.

intervals of an hour. Barometer and thermometer readings were taken hourly throughout the night. Six circumpolars, at least, three at upper culmination and three at lower, were always observed upon a long night, and three nadir, level and collimation determinations were made. Readings were also made upon the south collimator at the beginning and end of the work, to serve as a check upon the azimuth in case the last pair of circumpolars should be lost by clouds.

The routine from beginning to end of the night—twilight to twilight—was practically uninterrupted; the chronograph was never suffered to run down, and I could easily substitute a new sheet while the cylinder was making one-third of a revolution. Usually, however, two sheets, corresponding to four hours' work, were fastened upon the barrel at a time, and it was then the work of a few seconds only to strip off the upper one. During the day, the transits—more than 4000—upon the chronograph sheets were read off, the stars were identified and the observations were recorded, and a new programme was arranged for the coming night. The basis of the programme was our Zone Catalogue, of course, but all the anonymous stars of which the observer gave any note during the observations were also incorporated.

The above was the rigorous procedure during the month of December, not omitting readings for runs and any other desirable operation that could be performed in daylight. During all this time there was neither strain, nor hurry, nor fret over a failure, but every operation was in the charge of an assistant who knew how to do it well in the least possible time. The longest nights were those of December 23, 24, 25 and 26—32 hours in all—aggregating 1549 complete determinations. The gentlemen who assisted me were Messrs. BACHMANN, DAVIS and STEVENS, but in the circle room there was no distinction of person and we alternated according to rule. I had employed the same method during the four preceding months, also, but in less degree, and by way of practice."

ARGENTINE NATIONAL OBSERVATORY,  
CORDOBA, June 24, 1891.

GIFT TO THE LICK OBSERVATORY FROM PROF. MICHELSON.

In Vol. III of the *Publications* (page 274) Prof. MICHELSON describes an apparatus devised by himself for making measures of very small angles by interference methods and gives observations