

THE SIMEIZ PLATE COLLECTION OF THE ODESSA ASTRONOMICAL OBSERVATORY

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Abstract. Here we describe the Simeiz observatory astronomical plate archive, which is now a part of the Odessa Astrophotonegative Collection. The archive contains about 10000 plates received during period 1908-1953 with Double 120 mm astrograph, which was originally installed in 1908. In the Simeiz archive there are plates taken also at the Kitab International Longitude Station (Uzbekistan) during the World War II where the astronomers from Simeiz were evacuated. The Simeiz plate archive contains observations of small bodies of the Solar system (asteroids), planets and their satellites. Several hundred plates contain images of various objects and phenomena: comets, variable stars, lunar eclipses, etc. Now complete set of plates (including plates obtained in Kitab) are stored in the Astronomical Observatory of Mechnikov Odessa National University at the Mayaki astronomical station in comparatively good conditions. In the period 2014 – 2015 a part of the archive was digitized using the flatbed scanner EPSON Perfection V700. Recently we started work on processing the metadata of the plate envelopes in the machine-readable catalogue compatible with the IVO-WFPDB standards.

1. INTRODUCTION

Our report is devoted to the collection of plates of the Simeiz Observatory. The first plates of this collection were received in 1909. At the end of 1953, the number of plates reached more than 7,000. In 1966, the archive of the Simeiz plates was moved from Crimea to Odessa by agreement between director of Simeiz observatory A.B. Severnyy and director of Odessa observatory V.P. Tsesevich for study variable stars on these plates. Thus, the Simeiz collection became part of the Odessa plate archive, a unique source of information on the long-term behavior of objects (Karetnikov, et al. 1994).

During a difficult period (1909 - 1953), 41 years of observations in Simeiz, a relatively small group of observers showed steadfastness and enthusiasm. The collection of plates was received due to astronomers who received world fame: S. I. Belyavsky (1883-1953), G.N. Neumin (1886-1946), V.A. Albitsky (1891-1952), G.A. Shain (1892-1956), and P.F. Shain (1894 - 1956. Please do not forget names of the founder of the Simeiz Observatory N.S. Maltsov (1849 - 1939) and the organizer and first astronomer of this observatory A.P. Gansky (1870 - 1908).

The main program of observations was the study of small planets of the Solar System. Program also included observations of asteroids, Major planets and their satellites. Several hundred plates contain images of various objects and phenomena: comets, variable stars, lunar eclipses, etc. Having joined the International Organization for the Observation of Small Planets in 1912, the Simeiz Observatory occupied leading place in the world in terms of the number of observations and new objects discoveries before World War II, performing about one-sixth of the whole observational work of organization. So, for example, G.N. Neumin from 1914 to 1939 published positions of 2791 asteroids, which he observed by himself. Among these, about 250 objects were listed as new. In total, more than ten comets were discovered, 8 of them were given the names of Simeiz scholars; 151 asteroids, including the first opened by Neumin asteroid, named in honor of Simeiz, place where first amateur observatory in Crimea was founded by N.S. Maltsov. The best known comets that was successfully observed in Simeis are comets Halley (1910), Brooks (1911), Fork (1930), OakRidge (1940), etc. (Karetnikov, et al. 2007).

2. THE SIMEIZ PLATE COLLECTION

A collection of astronomical photographic plates was obtained at the Simeiz Observatory (44° 24' 47"N, 33° 59' 27"E, height - 360 m) (Fig. 1) on the Double 120-mm astrograph with the Unar lens by Carl Zeiss (Fig.2). The analysis of the observation logbooks and its electronic version made it possible to distinguish several observation periods, which are separated in eight separate archives according to the specification of the Database in Sofia (Tsvetkov, 2006). In general, the whole collection contains about 8 thousand plates.

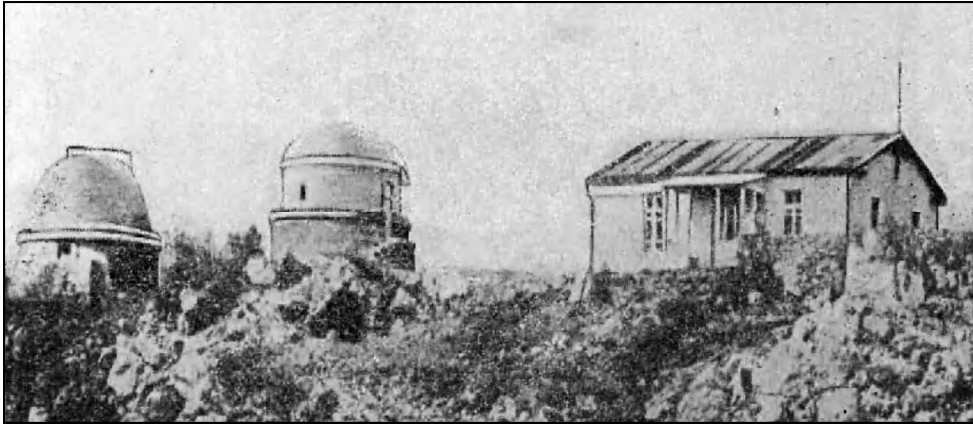


Figure 1: Simeiz Observatory (photo 1908).

It was founded by N. S. Maltsov as an amateur observatory, but was later associated as a branch of the Pulkovo Observatory with the participation of the astronomer A. P. Gansky.

In the evacuation period (1942-1944), during World War II, observations were made at the Bredikhin Double astrograph in Kitab, Uzbekistan.

Characteristics of the Simeiz Double astrograph are given in Table 1.

Table 1: Date of observations is from JD 2418405 to 2434725 (1909-1953).

Type of objective	No. of cameras	D, mm	F, mm	Plate size, mm	Field of view, °	Lim. Photo graphmag, ^m	FoV center shift from guide star, °	Emulsion types	Exposition
UNAR	1 & 2	120	600	130 x 180	12 x 16	~ 15 (pg)	0	> 10	up to 2 ^h

The centers of the plate field were determined by the position of small planets, comets, and their expected area of presence. Most observations of small bodies was fulfilled according to the method of Metcalf: the method of intermittent guiding of an object, with exposures up to 1.5 - 2 hours. The coordinates are indicated on the envelopes of the plates. In Fig. 3 we gave the observational statistics of 1910 as an illustration of the seasonal distribution of observation nights during the year. Distribution of plates with years is shown in Fig. 4.

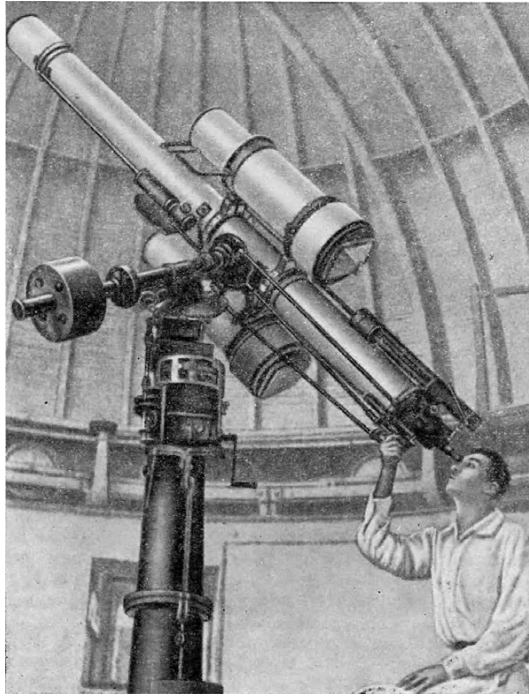


Figure 2: Double 120 mm astrograph with Unar lens by Carl Zeiss (established in 1908).

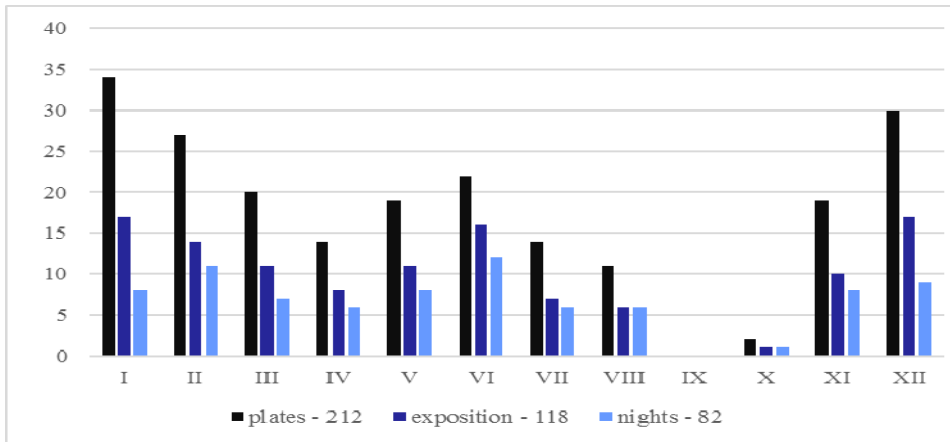


Figure 3: Observation statistics in Simeiz in 1910.

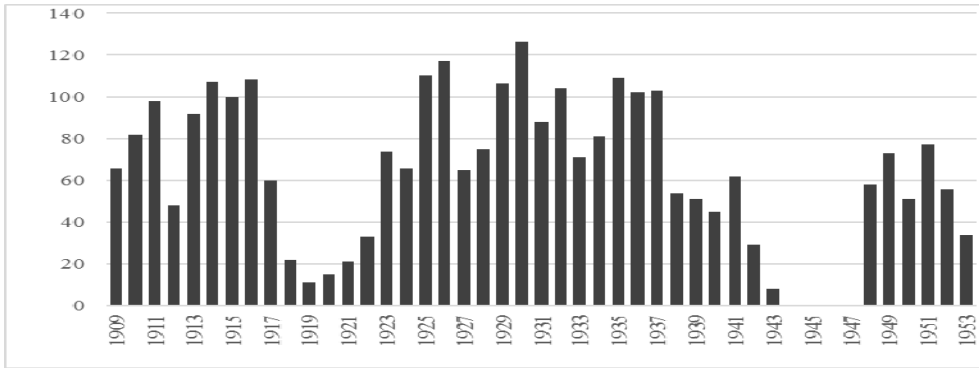


Figure 4: Observation statistics in Simeiz from 1909 to 1953 (Andrievsky, et al. 2007).

During more than 40 observational years more than 10 types of astronomical emulsions were used. Unfortunately, we do not have much information about types, recipes, methods of processing etc.

3. PRESENT STATE OF THE SIMEIZ PLATES COLLECTION

Now all plates of the Simeiz collection are stored in the Astronomical Observatory of Mechnikov Odessa National University at suburban Mayaki astronomical station (40 km from Odessa).

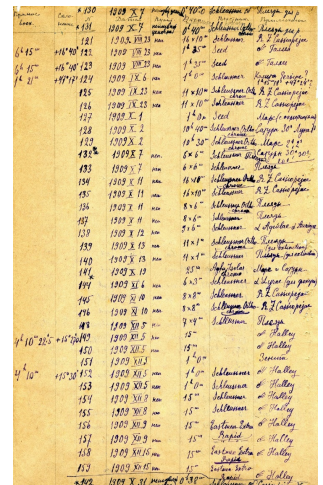
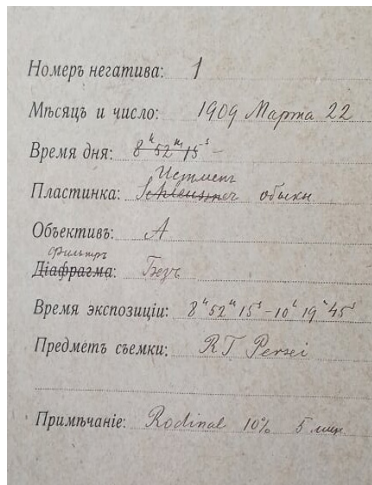


Figure 5. a: Wooden cupboard with the Simeiz plates, **b:** envelope of the first plate in collection, **c:** Fragment of an observational logbook.

The plates are packed in paper envelopes and stored in time ascending order in 4 wooden cabinets in an isolated from the whole collection room in the administrative building of the observation station. Storage conditions are close to maximum allowable: with low air circulation, seasonal changes in air temperature in the range $+3 - +30^{\circ}\text{C}$ and non-controlled humidity of air. Also re-recorded logs are stored in the glass library as the originals are absent.

4. DIGITIZATION OF THE SIMEIS COLLECTION OF PLATES

Since 2013, the project of digitizing the Odessa photographic plates archive has been launched. Plates in small batches were transported from Odessa to Kiev (the Main Astronomical Observatory of National Academy of Science of Ukraine). About 400 plates of the Simeiz collection were digitized on the scanner Epson Expression 10000XL for one year. Images were digitized as 16-bit grayscale FITS with a resolution 1200 dpi. Size of one image is about 400MB.

Images integrated in the combined digital archive of Ukrainian Virtual Observatory Joint observation Data Archive (JDA). To date, the JDA contains 600 metadata records and more than 400 digitized images of selected plates of the Simeiz collection (1951 - 1953) with low resolution (for preview) (Vavilova, et al. 2012).

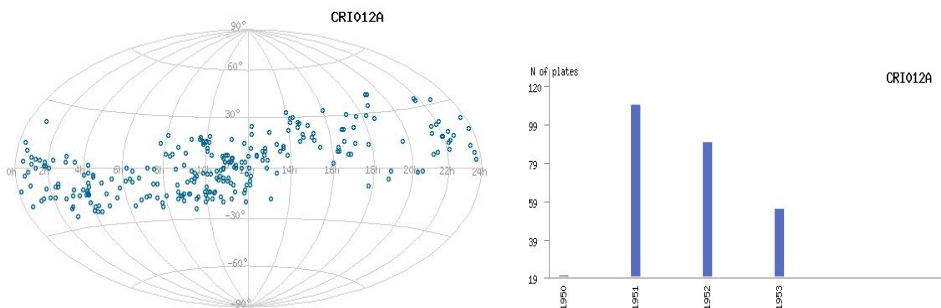


Figure 6: Plates distribution & Archive statistics CRI012A (1951 - 1953)
From DATABASE of JOINT PLATE ARCHIVE (DBGPA V2.0)
<http://gua.db.ukr-vo.org/guides.php>.

In the summer of 2014 to Odessa glass library, sponsors have donated the Epson Perfection V700 Photo scanner (the A4 format, optical resolution 6400x9600 dpi, depth of color, bit: 48) complete with office equipment serving the scanner. From this date digitization of the Odessa archive began to be conducted locally, not taking out of its far from its storage place.

The plates are digitized in 16-bit TIFF format, $20 \mu\text{m}$ / pixel. Size of one image is about 90 MB at 1200 dpi resolution and about 350 MB at 2400 dpi. Scanner Epson Perfection V700 was investigated by original methodology of V.

Andruk (Andruk, et al. 2015). As a result, he concluded that for rectangular coordinates mean-square error of value of one difference determination is $\sigma_{xy} = 0.023$ pixels for the 1200 dpi scanning mode; for instrumental stellar magnitudes, the mean-square error value of one difference determination is $\sigma_m = 0.013^m$ (Kashuba et al, 2017).



Figure 7: The workplace of the Epson Perfection V700 Photo Scanner operator.

At the preparatory stage of placing the digitized material in the database of the Bulgarian Data Processing Center (WFPDB) the following work was done:

- the original machine-readable catalog, recorded from observational logbooks and envelopes of the Simeiz collection and prepared in 2002 ((Pikhun, et al. 2002)) was presented in WFPDB format in 6 tables:

1. SIM012Aavi
2. SIM012Adigit
3. SIM012Amaindata
4. SIM012Anotes
5. SIM012Aobserver
6. SIM012Aquality

- the centers of the plates with use of service astrometry.net are specified;
- preview scans (See Figure 8, 9 for examples) with low resolution (600 dpi, jpg) were prepared;
- observational logbooks and part of the envelopes of the plates were digitized.

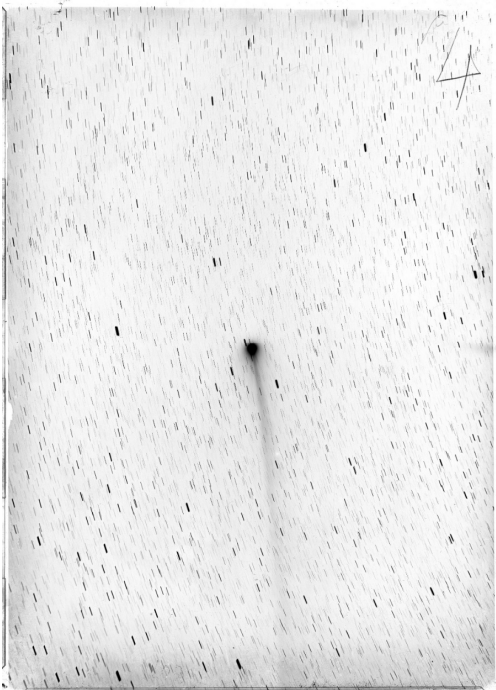


Figure 8: Preview pl. № 607=SIM012A000607. Brooks comet, 16.09.1911, exp. 150.0 min.



Figure 9: Preview pl. № 1464=SIM012A001464. Delavan comet, 20.09.1914, exp. 80.0 min.

In May 2018, the processed data of Simeiz plates (887 SIM012A - 80GB) covered the period 1909-1915 were sent at Wide-Field Plate database in Sofia (See Fig. 10-12) (Kirov, et al. 2014).

<u>Name</u>	<u>Last modified</u>	<u>Size</u>	<u>Description</u>
 Parent Directory		-	
 SIM012A/	03-May-2018 15:20	-	
 SIM012A_logs_1-2129/	08-May-2018 11:53	-	

Figure 10: Index of/ftp/WFPDB/archives/SIMEIZ.

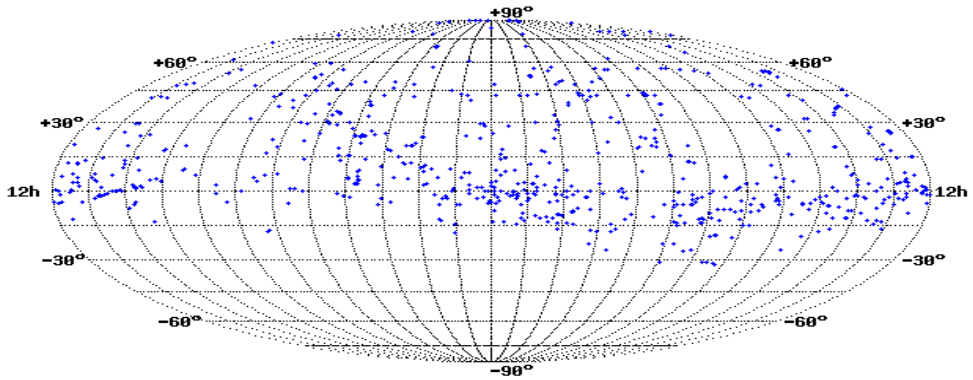


Figure 11: Distribution of 887 plates SIM012A on the sky in the Mollweide projection.

[WFPDB](#) [WFPDB@VizieR](#) [Aladin](#) [All WFPDB Archives](#) [Active WFPDB Archives](#)

Details for: SIM012A000116

IDObs: SIM	OBJNAM: PLEYADES
IDins: 12	OBJTYP:
IDSuf1: A	METHOD:
IDno: 000116	MULTEX: 1
IDSuf2:	EXP: 130.0
RAJ2000: 03 46 41	EMULS: SCHLEUSSNER
DEC2000: 24 06 10	FILT:
CCOD:	SPEC: PG
DATE: 1909 08 22	DIMx: 13
UT: 10 48 00	DIMy: 18
TCOD:	
QUALITY: 1	
NOTES: 19090822 Exp time 104800 to 125800 min 9x14 object Pleyades	
OBSERVER: S.Belyavskiy	
AVAILABILITY: AVAILABLE IN ODESSA ASTRONOMICAL OBSERVATORY	
DIGITIZATION: DIGITISED WITH SCANNER EPSON PERFECTION V700 PHOTO 16BIT(1200DPI)	
Original Log-book scan: logbooks/SIM/012A/SIM012A_000081-000120.jpg	
Original Plate archive link:	

PREVIEW: N/A SCAN: N/A

Figure 12: Screenshot of the catalog page SIM012A in WFPDB (www.wfpdb.org).

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