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ASTRONOMICAL RECORDS IN THE RUSSIAN CHRONICLES FROM 1000 TO 1600 A. D.

(as collected by D. O. Sviatsky)

BY

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Introduction

The present work was undertaken at the instance of a resolution of the International Astronomical Union in 1938.[1] The magnitude of the task would have been prohibitive for the present writer had it been necessary to search the monumental edition of the Complete Collection of the Russian Chronicles, the first folio volume of which was published early in the nineteenth century and the last of which has not yet appeared. Happily, however, it was found that D. O. Sviatsky after critical investigation had collected all the available astronomical portions of the texts and had published them in the original archaic Russian.[2] In this undertaking he was assisted by the late M. A. Viliev, who recomputed the circumstances of the solar and lunar eclipses which had occurred in Russia, inasmuch as the information contained in Oppolzer's Canon der Finsternisse frequently proved to be insufficient.

Russia of the tenth century was converted to Christianity by the Greeks; consequently the political and cultural influence of Byzantium was predominant at the beginning of this period and continued strong for many centuries. The earliest Chronicles were patterned very closely upon the Byzantine Chronicles, and were written in the monasteries first under the close supervision of Greek bishops, and later under the guidance of Russian priors. Two aspects of the Chronicles should be noted. They were written in the language then spoken by the native population, whereas the West European Annals were usually written in Latin. Furthermore, the writing of the Chronicles was uninterrupted and interconnected through many centuries. It was the custom for any chronicler to copy much of the previous writings of several monasteries, and then continue with the record of his own times. The result was a great number of copies, compilations and variants, and the outstanding problem for Russian historians is the establishment of the chronological sequence of different copies, and of the primary source of different records.

Russia between the eleventh and the fourteenth centuries was an agglomeration of many small principalities. The rulers or princes were all related by blood. One

[1] Transactions of the I. A. U. *6*, 337, 1938.

[2] Astronomical Phenomena in Russian Chronicles (in Russian), Bulletin Imp. Academy of Sciences (division, Russian Literature) Vol. 20, p. 87, Petrograd, 1916. This work is not listed in the Astronomische Jahresbericht for 1916. Later Sviatsky published two short articles on the subject (JBAA, *33*, 285, 1923 and Popular Astronomy, *38*, 587, 1930; the first of these was reprinted in BSAF, *37*, 418, 1923).

of them was always considered the head of the family, and was referred to as the Grand Prince. Nevertheless, there was continual struggle and political intrigue between the rulers, because different principalities were not equally valuable, and because no law of succession from father to son was operative until the Moscow princes became dominant late in the fourtheenth century. In this political strife the written word of the Chronicles frequently served as a powerful instrument.[3]

Although the Chronicles were written in monasteries, the church in Russia, just as in Byzantium, was in close cooperation with the secular power of the princes. Consequently, the writer of a chronicle tended to omit any information unfavorable to the local prince and to emphasize the favorable facts. However, there was seldom, if ever, any outright distortion of facts. Thus the Chronicles are to some extent political documents, which nevertheless supply an enormous amount of historical material.[4]

The Russian climate is not very favorable for astronomical observations. Winters are mostly cloudy, and summer nights are very short. Consequently, knowledge of the constellations and of planetary motions has always remained rather meager among the Russian population. Furthermore, the predominantly Byzantine religious culture was not favorable for the development of a scientific attitude. The prevailing view among clergy and laymen was that when celestial phenomena were as usual, there was nothing to worry about, but when something unusual happened, it was worth recording, it being a sign of God's will, favorable or unfavorable. Thus, solar and lunar eclipses, appearances of comets, fireballs, and bright auroras were interpreted in connection with political events, occurrences of disasters, etc.

No original manuscripts of Chronicles written earlier than the fourteenth century have been found, but only later copies of these. The names given to the different chronicles or copies derive either from the locality where the manuscript was found (i. e. Hypatievsky), or from the name of the person who made the copy (i. e. Lavrentievsky). More than 200 different manuscripts are known at present. The accompanying map of medieval Russia will help to identify the localities mentioned in the records.

The chronology of the phenomena recorded in the Chronicles frequently suffers from lack of precision. The years were counted from the "Creation of the World", and this event, according to the Byzantine church occurred in the year 5508 B. C. In the earliest part of the period the beginning of the year was counted from the day of the first new moon after the spring equinox (the so called "Spring Year", whereas later was introduced the "Church New Year", which began on September first. However, since the two modes of recording persisted side by side through most of this period, a certain amount of confusion was inevitable. Consequently the

[3] A short account of Russian history during this period may be found in The Tale of the Armament of Igor (Oxford University Press, London, 1915) by L. A. MAGNUS.

[4] A thorough analysis of the Russian Chronicles will be found in M. D. PRISELKOV's History of Russian Chronicle Writing in XI to XV Centuries, Leningrad, 1940 (in Russian). See also S. H. CROSS (reference 8).

recorded year may be in error by as much as two or three years. The day of the month, which was usually connected with the memory of a saint, is much more certain, as is the day of the week. Finally, the hours of the day were counted from sunrise to sunset, i. e. 0^h was approximately 6 A. M., and 12^h, 6 P. M. The hours of the night were similarly counted from 6 P. M. on.

The phase of an eclipse is frequently indicated in the Chronicles by comparison with the moon at a given age. The following table gives the relation of these estimates with Oppolzer's method of expressing the phase in inches.[5]

Days after the new moon	Fraction of the sun's diameter	Inches
1	0.99	11.9
2	0.95	11.4
3	0.90	10.8
4	0.83	10.0
5	0.74	8.9
6	0.64	7.7
7	0.54	6.5
8	0.43	5.2

In computing the phase of an eclipse Sviatsky usually chooses the city of Smolensk since its position was fairly central for the region occupied by Russia in medieval times. In the case of solar eclipses he gives the local mean time at Smolensk; for lunar eclipses Poulkovo mean time (P. M. T.) is given and the phase is again expressed in inches.

In presenting here the astronomical records found in the Chronicles we have followed Sviatsky as far as the identification of the various phenomena is concerned. He identified the eclipses by means of Viliev's "Canon of Russian Eclipses".[6] His identifications of comets were frequently made possible by consulting the Western records, especially those collected by Pingré. The dates of fireballs, auroras, etc. were arrived at by examining critically all the information present in the records, i. e. the day of the week, the name of the saint, etc.

These astronomical observations may be studied from various points of view. For the astronomer they present authentic observations which contain some very interesting details; thus solar prominences were first described in Russia in 1185, apparently some 600 years earlier than the first similar observation made in Western Europe.[7] Similarly, the Russians, not being inhibited by Aristotle as were the Western Europeans, recorded sunspots in 1371, more than two hundred years before Galilei's observations. Again, the historian may use the dates of eclipses for the problems of chronology. Finally, the records throw light on the development of human knowledge. For instance, in connection with the solar eclipse of April 19,

[5] OPPOLZER, Canon der Finsternisse, p. XXIV, ff.

[6] SVIATSKY, l. c., p. 97.

[7] E. PETTIT, Publ. Astr. Soc. Pacific, 55, 184, 1943.

1064 the chronicler finds it necessary to cast doubt on the opinion that the sun was literally being eaten up, and yet the expression "the sun perished" was in use through most of the period with which we are concerned.* Whereas in 1563 there is evidence of a definite understanding of the true cause of the solar eclipse: "... as if the moon came under the sun ..."

The astronomical records are here grouped in five divisions: 1) solar eclipses; 2) lunar eclipses; 3) comets; 4) meteor showers, fireballs and auroras; 5) sunspots and daylight visibility of planets. No other phenomena, such as appearances of novae, have been found recorded. In each division the following order of presentation is used. First the identification of the phenomenon is given together with its date according to the Julian calender; if it is an eclipse, the number of the Oppolzer Canon is included in parentheses; if it is an identified comet, its perihelion passage is given. Following this, each record begins with the accepted name of the manuscript and the year as recorded there (from the "Creation of the World" in 5508 B. C.). Usually after one or more records are quoted, there follows a selection from the copious comments made by Sviatsky. Occasionally the present author has found it advisable to make his own comments; these are enclosed in brackets.

In order to translate the texts collected by Sviatsky into any modern language, a knowledge of astronomy and of the old Slavonic languages is necessary. The author was fortunate in finding an able assistant in Mrs. Olga I. Podtiaguine of Charlottesville, Virginia, U. S. A., who devoted much time and effort to the preliminary rendering of the records into English. The author is greatly indebted to her for successfully performing this part of the work. The ordinary difficulties and subtleties of translation are much enhanced when we deal with an archaic language. We have attempted to strike a happy mean between free rendering and a literal translation. A few of the passages in the present compilation had previously been translated by S. H. Cross[8]; a comparison with our independent translation indicates very good agreement in the interpretations.

I am indebted to Professor M. M. Karpovich of Harvard University, and to Professor N. T. Bobrovnikoff of Perkins Observatory, who called my attention to several important books which treat the general problem of the Russian Chronicles. My thanks are also due to Mr. P. P. Lepiken, of Washington, D. C., who has helped to translate correctly a few of the more difficult passages. The clerical expenses were partly covered by a grant from the American Philosophical Society; further assistance was provided by the Leander McCormick Observatory of the University of Virginia. Finally, I am indebted to the Observatory at Lund for the inclusion of my paper in its publications.

* The Russian verb "pogibnut" means literally "to perish" as with a soul cast into Hell. Used in connection with a solar eclipse the word originally reflected the fear that the sun was actually being destroyed. The present author has translated it as "perish" in the records earlier than 1200 A. D. In the later records the expression "lost its light" is substituted.

[8] The Russian Primary Chronicle. Harvard Studies and Notes in Philology and Literature, *12*, 77. Cambridge, 1930.

I. Solar Eclipses

Annular eclipse of April 19, 1064 (5393)

Lavrentievsky (6572): Before this time even the sun changed and was not bright but became like the moon. Ignorant people said that the sun was being eaten up.

This is the earliest reference to a solar eclipse found in the Chronicles but the exact time is not given. While the chronicler recorded the opinion of "ignorant people" he seems to be rather skeptical about what they said.

Annular eclipse of May 21, 1091 (5457)

Lavrentievsky (6599): During the same summer occurred a sign in the sun. It perished and little of it was left, like a crescent of the moon; this occurred in the second hour of the 21st day of May.

The phase of the eclipse in Smolensk was nine inches.

Novgorodsky III (6586): Bishop Herman was made bishop of Great Novgorod. During his term of office a sign in the sun was seen. It perished, and little of it was left, like a crescent of the moon. It happened in the second hour of the day, on May the 21st.

In the Pskovsky I and Voskresensky chronicles there are two records under the year 6596 worded almost exactly like the preceding ones, but neither in 1078 nor in 1088 were there any eclipses on May 21. Therefore these records must refer to the same eclipse of 1091.

Total eclipse of August 1, 1100 (5497)

Hypatievsky (6614): During the same year a darkening of the sun occurred in August.

The eclipse for Smolensk had the phase of 9.5 inches at 5: 08 A. M.

Total eclipse of March 19, 1113 (5513)

Lavrentievsky (6622): During the year 6622 there was a sign in the sun in the first hour of the day. All the people could see it; little was left of it, just like a crescent of the moon with its horns downwards. It happened on the 19th of March.

Gustinsky (6621): On the 19th of March there was a terrifying darkening of the sun and very little was left of it. On the fourth day of the same month the moon darkened. During the same year, on the 16th of April, after Easter, Sviatopolk passed away.

There is a short record of the same eclipse in the chronicle of Avrahamka under the year 6621. But other chronicles, such as Novgorodsky II, Pskovsky I, Niconovsky and Voskresensky record this eclipse under the year 6622. For Smolensk the phase of the solar eclipse was seven inches at 7: 48 A. M. The zone of totality moved from Egypt across Arabia and Siberia toward the north pole; therefore, for Russia the crescent had to be with its horns downwards.

Total eclipse of July 23, 1115 (5520)

Hypatievsky (6623): During this year there was a sign. The sun perished and became like a crescent of the new moon. Ignorant people said the sun was eaten up. Prince Oleg Sviatoslavovich died on the first of August of the same year.

Novgorodsky I (6623): During this year there was a sign in the sun, as if it perished.

For Smolensk the phase of this eclipse was ten inches at 4: 48 A. M.

Total eclipse of March 10, 1122 (5537)

Lavrentievsky (6630): There was a sign in the sun in the month of March, on the tenth day.

In the Hypatievsky the wording is even shorter, but the year is given as 6629, and a similar record is found in the Niconovsky under the year 6630. For Smolensk the phase was not great, only four inches at 7: 08 A. M.

Total eclipse of August 11, 1124 (5542)

Novgorodsky I (6632): In the month of August on the 11th day, before the evening service, the sun began to diminish and perished completely. Great fright and darkness were everywhere. And the stars appeared and the moon. And again the sun began to augment and its face became full again and everybody in the town was very glad.

Almost the same record is found in the Novgorodsky II and IV, in Pskovsky I, Tverskoy, and Voskresensky chronicles. The Lavrentievsky gives a different description:

During the same year there was a sign in the sun. In the ninth hour of the day it became like a small crescent of the moon. It darkened quite a bit in the afternoon of the eleventh day of the month of August.

A similar record is found in the Hypatievsky chronicle. In the Niconovsky both versions are combined. The phase of the eclipse for Smolensk at 2: 28 P. M. was 10.5 inches. The time corresponds to the ninth and tenth hours of the church time, that is just before the evening service. The zone of totality crossed Finland, the present Leningrad, and continued almost centrally over Novgorod, Tver and Moscow. The observation recorded in the Lavrentievsky was probably made near Kiev, where the eclipse was only partial.

Total eclipse of March 30, 1131 (5338)

Novgorodsky I (6639): There was a sign in the sun, during the evening service, on the 30th day of March.

There is a similar record in the Tverskoy chronicle. For Smolensk the greatest phase was six inches at 5: 28 P. M.

Total eclipse of August 2, 1133 (5565)

Novgorodsky I (6641): There was a sign in the sun before the evening service.

There are similar records in the Novgorodsky II and Tverskoy chronicles. In Smolensk, the greatest phase of eight inches was at 2: 00 P. M.

Total eclipse of March 20, 1140 (5582)

Novgorodsky I (6648): In the year 6648, on the 20th day of March, there was a sign in the sun, when as much was left of it as is the moon on its fourth day, but before the sunset the sun became full again.

The same record is found in the Novgorodsky II. The Tverskoy chronicle gives only a very brief account. In Smolensk the eclipse was total at 5: 04 P. M. The zone of totality passed from East Prussia through Vitebsk and Moscow, and broke off before reaching Kasan. In Novgorod the eclipse was partial, and its phase "like the four-days old moon" was almost ten inches.

Partial eclipse of June 11, 1146 (5596)

Niconovsky (6654): During the same year there was a sign in the sky. The rays of the sun perished and the moon was bloody.

In Smolensk the phase was six inches at 4: 12 A. M. A lunar eclipse which was visible in Russia the same year occurred on November 20.

Annular eclipse of October 26, 1147 (5600)

Lavrentievsky (6655): During the year there was a sign in the sun, and on the very same night there occurred a thunderstorm which caused much damage.

The phase of this eclipse in Smolensk was 7.5 inches at 12: 44 P. M.

Total eclipse of May 1, 1185 (5694)

Lavrentievsky (6694): On the first day of the month of May, on the day of the Saint Prophet Jeremiah, on Wednesday, during the evening service, there was a sign in the sun. It became very dark, even the stars could be seen; it seemed to the men as if everything was green, and the sun became like a crescent of the moon, from the horns of which a glow similar to that of red-hot charcoals was emanating. It was terrifying to men to see this sign of the Lord.

Novgorodsky I (6693): On the first day of May, at the tenth hour of the day, as the church bells were ringing for the evening service, the sun darkened for an hour or more and the stars appeared. Then again the sun became bright and we were very glad.

Novgorodsky II (6693): On the first day of the month of May, during the ringing of the bells for the evening service, there was a sign in the sun. It became very dark for an hour or longer and the stars were visible and to men everything seemed as if it were green. The sun became like a crescent of the new moon and from its horns a glow like a roasting fire was coming forth and it was terrible for men to see the sign of the Lord. Then the sun cleared and we were happy again.

Pskovsky I (6693): At the time of the evening service there was a sign in the sun. It became very dark for an hour or longer, and we saw the stars and everything seemed green. And the sun appeared like a new moon and from its horns something like a fire burning was coming forth. It was terrible for men to see the sign of the Lord.

Niconovsky (6694): During the same year, in the month of May, on the first day, on the day of the Saint Prophet Jeremiah, on Wednesday, at the time of the evening service, there was a sign in the sun. It was very dark for more than an hour, the stars could be seen, and men saw everything in green color, and the sun became like a crescent of the moon, and from its horns a scorching fire was coming forth. This was a very frightening and terrifying sight.

Hypatievsky (6693): Prince Igor Sviatoslavovish, Oleg's grandson, left Novgorod on Tuesday, April 23. He took with him his brother Vsevolod from Trubezk and Sviatoslav Olgovich, his stepson from Rylsk, and Vladimir, his son, from Putivl. And thus they travelled slowly, gathering their army. As they were approaching the river Donetz, in the evening hour, Igor looked up to the sky and saw that the sun appeared like a crescent of the moon. And he spoke to his nobles and his army, "Do you see it? What does this sign mean?" They all looked up and saw it and hung down their heads and said, "Prince, this sign is not for good". But Igor said, "Brothers and my army, nobody knows the mysteries of the Lord; he has created this sign just as he has created the whole world. We will see in due time anything that God will do, be it for our good or for our evil."

For Smolensk this eclipse had the phase of 10.5 inches at 4: 48 P. M. The zone of totality passed from the Scandinavian peninsula across the Baltic Sea, then through Leningrad, Lake Ladoga, Lake Chudskoe, the city of Novgorod, and toward Vologda and Kostroma. The duration of the eclipse was almost three minutes.

The first five descriptions of this eclipse are very similar and are all simply variations of one original recording, probably that of the Lavrentievsky. Therefore the actual observation must have been made in or near Novgorod, where as we

know, the eclipse was total. But in the Hypatievsky the eclipse is described just as it was observed on the banks of the river Donetz, i. e. as a partial one.

A reference to this eclipse is also found in The Tale of the Campaign of Igor, Son of Sviatoslav, Grandson of Oleg.* There the author of the epic writes as follows:

> Then Igor looked up toward the bright sun and saw that all his men were covered with darkness which emanated from the sun.

In the descriptions of this eclipse we find one very interesting detail, namely the mentioning of the glow which was coming forth from the horns of the darkened sun. This seems to be an authentic reference to prominences, which sometimes reach so far from behind the disc of the moon that they can be seen with the naked eye.** In the various chronicles these emanations were described as follows: 1. Glow of red-hot charcoals (Lavrentievsky); 2. Burning coals (Tverskoy); 3. Roasting fire (Novgorodsky II); 4. Burning fire (Pskovsky I); 5. Scorching fire (Niconovsky). These consecutive variations were apparently introduced by the later writers who were not personal eyewitnesses of the event and could not appreciate the original description, "a glow similar to that of red-hot charcoals". [Since Novgorodsky I does not record any red glow, that record was probably an original one and not a copy.]

Total eclipse of September 4, 1187 (5701).

Novgorodsky I (6695): During the same year, in September, on the ninth day, there was a sign in the sun, about noon, when it became dark, and the sun appeared as a crescent. But after a short while it filled in again and became brilliant.

A similar description is found in the Novgorodsky II.

Hypatievsky (6695): During the same year there was a sign in the sky, on the fifteenth day of September. Darkness spread all over the earth, and the people were much astonished. The sun perished and all the sky was aglow with flame-like clouds. Such apparitions do not foretell anything good because that very day Jerusalem was captured by the godless Saracens. However, these signs are not visible all over the earth but only in such places where the Almighty wishes to bring some misfortune. Also it was said that there was a great darkness in Galich where even the stars were visible as the sun went out in the middle of the day. But in the vicinity of Kiev nobody saw anything at this time.

The error in dates has already been noticed by the Russian historian Karamsin. It is easy to see that in the case of Novgorodsky I the error was due to the similarity of the Slavonic characters representing the figures 4 and 9.*** [No such simple ex-

* Magnus, l. c.

** Dr E. Pettit on reading the above description remarks: "(It) is a good description of the chromospheric light which shows, with good seeing, at the tips of the horns of the crescent when the eclipse is nearly total ... I doubt that prominences would ordinarily be visible until within a few seconds of total phase. They are never recorded at annular eclipses."

*** c. f. Encyclopædia Britanica, 11th ed., Vol. 25, p. 232.

planation is possible for the Hypatievsky record since Jerusalem was taken by the Arabs from the Crusaders on the second of October; however, Ascalon was captured on the day of the eclipse.]

This eclipse moved from the Scandinavian peninsula, opposite the island of Gotland, where it was exactly at noon, toward the Black Sea, and over Galicia. Kiev district was to the north of the zone of totality. In Novgorod the eclipse was partial with the greatest phase occurring shortly after noon. In Smolensk the phase was ten inches at 1: 20 P. M. In Kiev and Galicia the eclipse was partial and occurred even later. The expression "flame-like clouds" suggests a peculiar color that the clouds take on during total or almost total eclipses. The presence of clouds may explain why the eclipse was not observed in Kiev.

Annular eclipse of February 28, 1207 (5749)

Lavrentievsky (6714): During the same winter there was a sign in the sky, in the sun, on the 28th of February, on Wednesday of butter-week,* and it lasted from noon till the evening service. What was left of the sun was like the crescent of the first-day moon. Many faithful people seeing this prayed that the Almighty might turn this apparition to the good.

The same description is found in the Niconovsky, and there is also a short version of it in the Voskresensky chronicle. Wednesday of butter-week fell in 6715 on the 28th of February, but in 6714 it was on February the eight. The central zone of this eclipse was more than two degrees wide. It passed across the Baltic Sea and Finland, and moved toward the White Sea. Thus the Gulf of Finland and Lake Ladoga remained to the south of the zone, but the phase in this region, as well as in Novgorod, was great; even in Smolensk it was 9.5 inches.

The phase given in the chronicle indicates that the observation was made near Novgorod and not near Kiev, where the phase was much smaller.

Total eclipse of May 14, 1230 (5808)

Lavrentievsky (6738): During the same month, on the fourteenth day, on Tuesday of the sixth week after Easter, the sun, as the people were watching it, began to disappear and little of it was left, and it became like a three-day old moon. And then it began to fill in again, and many people thought it was the moon travelling across the sky, because it was then the time between the moons. But other people thought that it was the sun who had begun to move backwards because many frequent and small clouds were moving very rapidly across the sun from north to south. On the same day and at the same hour the same apparition was seen in Kiev, where it was even more terrifying. Everybody there saw the sun become like the moon, and on both sides of it appeared two moving columns of scarlet, green and blue. Then a fire came down from the

* Butter-week is the week before the forty-day Lent. Cf. Encycl. Brittannica, 11th ed., Vol. 16, p. 428.

sky which looked like a huge cloud and stood above the creek Lebed. All the people despairing of their lives and thinking death was close at hand began to embrace each other and ask one another's forgiveness and they wept bitterly and prayed. In His goodness God led this terrible fire away through the city without any harm, and it fell down in the river Dniepr and that was the end of it. All this was told to us by witnesses who were there personally.

Niconovsky (6738): During the same year there were many signs but we will mention only one. In Kiev everybody saw the sun change into the moon, and on both sides of it there were columns red, yellow, green, black, and blue; then a fire came down from the sky in the shape of a large cloud right above the creek Lebed. Fear seized everybody, and confusion was everywhere, and people despaired of their lives, believing this was the end of the world. The fire in the mean time was moving back and forth as a very thick cloud and it went over the city not causing any damage. Everybody was crying and praying to our Lord with tears in their eyes.

Tverskoy (6738): On the fourteenth day of the same month, on Tuesday of the seventh week after Easter, at the third hour of the day, the sun darkened and became like the moon at the fifth hour of the night, and on both sides of it appeared columns red, green and blue. On the same day in Kiev a fire came down from the sky as a huge cloud just above the creek Lebed. People were in despair of their lives asking forgiveness of their sins and not expecting to live any longer. But the fiery cloud moved over the city without causing any damage, because the people prayed God with tears. But in Novgorod the sun was just like the young moon at the fifth hour of the night.

Novgorodsky I (6738): During the same year the sun darkened on the fourteenth of May, the day of Saint Isodor, on Tuesday, in the middle of the morning, and it was like the moon on the fifth night. Then it filled in again and all the people became happy.

The broad zone of totality passed across Sweden and northern Finland towards the north pole. In Smolensk the greatest phase was 10.5 inches at 6: 04 A. M. and in Novgorod it was somewhat larger. [The description of the phase given in Tverskoy is probably correct, since the moon setting "at the fifth hour of the night" (11 P. M.) will have a phase of 11.5 inches. The Novgorodsky I reckoning must be a result of misunderstanding on the part of the copyist.] The mysterious fire cloud could hardly be the solar corona. To begin with, the creek Lebed is south of Kiev; then the phase of the eclipse in Kiev was smaller than in Novgorod or Smolensk, not more than ten inches.

Annular eclipse of August 3, 1236 (5823)

Lavrentievsky (6744): There was a sign in the sun, on the third day of the month of August, on Sunday after dinner. Everybody saw the sun become like a four-day old moon.

A similar record is found in the Niconovsky chronicle.

Academichesky (6744): During the same year the sun lost its light all over the country.

Academichesky (6745): There was a sign in the sun, on the third day of August, the day of the Saint Fathers Dalmatius, Faustus, and Isaak, in the afternoon. A darkness overtook the sun from the west side, but it remained clear on the east side, and was like a five night old moon; then it darkened from the east, and was again as the five night old moon, but was clear on the west side; finally it filled in again.

Almost the same records are found in the Novgorodsky I, Tverskoy and Voskresensky. The central zone passed through Finland, then toward Vologda, Kostroma and Kasan. In Smolensk the phase was 10.5 inches at 1: 28 P. M. The phase given in the Lavrentievsky was only 9.95 inches, and that in the Academichesky, 8.9 inches; we conclude that the actual observation was made somewhere in the vicinity of Kiev.

Annular eclipse of March 23, 1270 (5909)

Novgorodsky I (6779): The sun darkened on the fifth Sunday of Lent, in the middle of the morning; it filled up again and we were glad.

Similar records are in Niconovsky and Simeonovsky.

Tverskoy (6779): During the same spring there was a sign in the sun. It all became dark on Wednesday of the fifth week of Lent early in the day, and it filled up again, and the people were glad.

The same record is found in the Voskresensky. The central zone passed slightly to the south of Kiev and moved to the provinces of Poltava, Kursk and Voronezh. The phase in Smolensk was 11.5 inches at 8: 12 A. M. The eclipse occurred on the fourth Sunday of Lent, which in 1270 fell on March 23, because Easter Sunday was on April 13 in that year. The word "Wednesday" in the Tverskoy chronicle is probably a corruption of the expression, "In the middle of the morning." [In Russian, Wednesday is called "the Middle Day"; also the word "nedelia" which originally meant Sunday, later signified the week.] If the words "all of it became dark" are taken literally, the actual observation must have been made in the vicinity of Kiev.

Annular-total eclipse of June 26, 1321 (6030)

Novgorodsky I (6829): During the same summer, on June 26, there was a sign in the sky before Mass. While the sky was clear the sun suddenly darkened for about an hour and was like the moon on its fifth night, and the darkness was as on a winter night. Then gradually it filled up again and we were very glad.

Novgorodsky II (6829): In the month of June, on the 26th, at the third hour of the day, the sun lost its light and became like the two-day old moon, and the

darkness was as on a winter night. And after an hour it was full again and we were glad.

The same text is also found in the Novgorodsky IV, Pskovsky II, and a few others. The Simeonovsky gives the date as June 20.

Academichesky (6829): In the month of June, on the 29th, at the third hour, the sun lost its light and what was left of it was like the moon on the second day. After one hour it filled in again.

The central zone of this eclipse passed in the vicinity of Smolensk and farther on toward Tver and Kostroma. The phase for Smolensk was twelwe inches at 7: 32 A. M. The phase recorded in Novgorodsky II could have been easily observed in both Novgorod and Moscow, but the observation recorded in the Novgorodsky I could have been made in the vicinity of Kiev, which was sufficiently distant from the zone of totality. Obviously the date in the Academichesky is wrong, [and so is the date in the Simeonovsky].

Total eclipse of November 30, 1331 (6055)

Novgorodsky I (6839): In the year 6839, on November 30, on the day of the Saint Apostle Andrew, there was a darkening of the sun and it lasted from the first hour to the third.

The same record is found in Novgorodsky II and IV.

Niconovsky (6839): There was a sign in the sky; the sun darkened.

This eclipse began at sunrise in the vicinity of Lake Onega and the zone of totality crossing the districts of Vologda and Nizhni-Novgorod, passed north of the Caspian Sea. In Smolensk its phase was eleven inches at 8: 56 A. M. As the sun rises in Novgorod on November 30 at 8: 40 A. M., it rose there almost completely darkened.

Total eclipse of May 5, 1361 (6122)

Niconovsky (6869): During the same year there was a sign in the sky. The sun lost its light and afterwards the moon turned into blood.

The zone of totality passed through the Caucasus, the Caspian Sea and into Siberia. In Smolensk its phase was 6.5 inches at 10: 52 A. M. As to the lunar eclipse, there was none in 1361, but there was one on November 23, 1360.

Annular-total eclipse of August 7, 1366 (6133)

Gustinsky (6874): On April the seventh, at the third hour of the day, there was a darkening of the sun.

Novgorodsky IV (6874): (Following a long narrative about the attack of the Egyptian Sultan on Antioch, Jerusalem and Sinai, the massacre of the monks

and the crucifixion of Michael, Patriarch of Antioch,' the chronicle continues.) The sun could not tolerate all this and hid its rays on August the seventh, at the third hour of the day. The sun looked then as a three day old moon and it was cut out at the north side; a greenish darkness came forth from the west; it lasted like this for an hour and then the points of the crescent turned to the south, then toward the earth, until it was again filled with light.

Niconovsky (6874): Not being able to tolerate all this the sun hid its rays in the month of August, on the seventh day, at the third hour of the day, and became like the three day old moon cut from the south. And blue and green darkness came from the west and this great darkness lasted for an hour. The sun had its points turned to the south, and it was like a crescent; and then the points turned toward the earth, and the darkness was very great. Then little by little the light grew stronger until the sun was full again and the sun was shining as usual.

The narrow zone of this eclipse passed to the south of Moscow, close to Tula and Riasan. In Smolensk the phase was eleven inches at 6: 20 A. M.; the cut was from the south, as is recorded in the Niconovsky but not from the north as is erroneously stated in the Novgorodsky IV. Since during the greatest phase the sun appeared with its horns toward the horizon, it is possible to determine the place where the actual observation was made. It must have been to the north of the zone of totality, near Moscow or Novgorod, but not near Kiev. Because the phase was that of the three day old moon, the observation was probably recorded in Novgorod, where the phase reached eleven inches.

Annular eclipse of July 29, 1375 (6154)

Novgorodsky I (6883): In the month of July, on the 29th, the day of the Saint Martyr Kalinik, on Sunday, a sign was in the sun.

Niconovsky (6883): During the same month of July, on the 29th, on Sunday, the sun lost its light early in the morning.

Avrahamka (6886): There was a sign in the sun, on the 29th of July, on Sunday.

Niconovsky (6886): There was a sign in the sun.

The eclipse occurred in 1375, on Sunday, July 29. Since there was no eclipse three years later, and in 1378 July 29 was on Thursday, the last two records are in error as far as the year is concerned.

Total eclipse of January 1, 1386 (6178)

Novgorodsky I (6893): During the same year in winter there was a sign in the sun, on January the first, the day of Saint Basil.

Niconovsky (6894): During the same winter on the first of January, on the day of the Great Basil of Caesarea, on Monday, at the dinner hour, the sun lost its light and all that was left of it was like the four day old moon, and again it filled in toward the evening hour.

Simeonovsky (6893): During the same winter, on January the first, the day of the Saint Father Basil the Great, at the seventh hour of the day, when the people had just finished their dinners, the sun lost its light and remained in darkness for two hours; then again it was filled with light.

The zone of totality of this eclipse passed over the southern shores of the Black Sea, across the northern Caucasus and the lower Volga River at Astrakhan. In Smolensk the phase was ten inches at 12: 36 P. M. The phase given in the Nicoновsky shows that the observation was made in the vicinity of Novgorod.

Partial eclipse of October 29, 1399 (6209)

Novgorodsky I (6907): The same autumn there was a darkening of the sun. It became dark, the sun lost its light, a crescent appeared in the sky, and then bloody rays of the sun appeared coming forth with smoke. It happened in the month of October, on the day of Saint Anastasius.

The Novgorodsky IV, Pskovsky I, and Avrahamka chronicles describe the same phenomenon and place it in the same year 6907; but the Sophiisky puts it under 6909, and the Niconovsky even under 6910. But in years 1400 to 1406 there was no solar eclipse visible in Russia. Although this eclipse was partial, its phase in Russia was very large. Thus in Novgorod the greatest phase was 10.7 inches, and the sun was then only eight degrees above the horizon. In Kiev the greatest phase of 9.8 inches was at 3: 00 P. M. The end of the eclipse was visible both in Novgorod and in Kiev, but in Moscow the sun set while still eclipsed. This means that the observation was made either in Kiev or in Novgorod, but not in Moscow. [It is difficult to decide whether "the bloody rays" were prominences or just some clouds.]

Total eclipse of June 16, 1406 (6223)

Tverskoy (6912): During the same year there was a sign in the sun, on the sixteenth day of June. The whole country witnessed it; all that was left of the sun was like the moon of the fourth day. It was obscured from the fourth hour to the sixth.

Academichesky (6914): On June the sixteenth, at the third hour of the day, there was a diminishing of the sun.

Niconovsky (6914): In the same year, during Saint Peter's Lent, on June the sixteenth, Wednesday, at the fourth hour of the day, there was a sign in the sky. The sun lost its light; as little was left of it as a three day old moon, and all was gloomy and dark. But after one hour the sun was again filled with light.

Almost the same description is found in the Voskresensky chronicle. The zone of totality crossed the Baltic Sea, Finland, and then moved toward the White Sea. The phase for Smolensk was 10.5 inches at 8: 32 A. M. The observation mentioned

in the Academichesky and Niconovsky was probably made in the vicinity of Novgorod, because the phase indicated there was 10.8 inches. The observation recorded in the Tverskoy chronicle was made farther to the south, and judging by the recorded time, farther to the east.

Total eclipse of June 7, 1415 (6244)

Novgorodsky I (6923): There was a sign in the sun in the month of June, on the seventh.

Novgorodsky II (6922): Then there was a sign in the sun.

Academichesky (6923): During the same year, on Friday, June the seventh, the sun lost its light and hid its greenish rays from the face of the earth.

Pskovsky I (6923): There was a sign in the sun visible in the whole country, on June the seventh. The whole sun darkened for a short time and one could see all the stars as at night.

Sophiisky II (6923): During the same year, on June the seventh, at the fourth hour of the day, there was darkness all over the country and the sun darkened just as during the crucifixion of Jesus Christ. The stars appeared, and the dawn and the twilight, and one hour later our Lord gave the light back to the world.

Tverskoy (6923): During the same year, on June the seventh, the day of the Saint Father Theodosius, at the seventh hour of the day, the sun lost all its light, and there was darkness all over and one could not distinguish the faces of men.

Avrahamka (6923): There was a sign in the sky on June the seventh. Darkness of green color spread over, and people could scarcely see one another. It started when they were singing the Mass.

Niconovsky (6922): During the same summer, on the seventh of June, darkness occurred on Friday before the Mass. It did not last very long, for just an hour or a little longer. All the stars were visible then, as during the night.

Niconovsky (6924): During the same year, on June the seventh, there was a sign in the sun. First the darkness was greenish, then it slowly became like blood; nobody could see anybody, all were standing as if in blood.

Supralsky (6923): During the same year, on the seventh of June, on the day of the Saint Martyr Theodosius, the sun lost its light and hid its rays from the earth in the fourth hour of the day, at the hour of the Holy Liturgy, and the stars appeared as at night.

Western-Russian (6923): During the same year on the day of the Annunciation, on Monday before Easter, there was a great sign about dinner time. The stars appeared as in the night, the sun darkened, and fright was great all over Russia.

The abundance of records of this eclipse may be explained by the great width of the zone of totality. It passed through central Russia, including Smolensk, Moscow and Nizhni-Novgorod. In Smolensk the eclipse had a phase of 11.5 inches at 8:32 A. M. The records of total darkness and the appearance of the stars probably

describe the phenomenon as it took place in the region near Moscow, but not in Kiev or Novgorod where the eclipse was not total. On the other hand, the accounts given in the Novgorodsky I and II refer to the observations made in Novgorod, because they do not mention the visibility of stars. The seventh of June in 1415 fell on Friday. The time of the day is everywhere recorded correctly, with the exception of Tverskoy. [The last record is completely erroneous, both as to the time of the year (Annunciation on March 25) and the day of the week (Monday).]

Total eclipse of June 17, 1433 (6284)

Pskovsky I (6941): (after a description of a thunderstorm of unusual violence on the fourteenth of June, the record continues) During the same week, on Wednesday, there was a sign in the sun at the ninth hour of the day.

In 1433 Wednesday after June 14 fell on the seventeenth. Also, the Pskovsky II places the eclipse directly on June 17. The phase in Smolensk was nine inches at 5: 44 P. M. The ninth hour refers probably to the beginning of the eclipse.

Total eclipse of July 18, 1460 (6343)

Novgorodsky IV (6968): On the eighteenth of July the sun lost its light.

Pskovsky I (6968): On the eighth day of July the sun lost its light, on Friday, at the second hour of the day. This lasted for half an hour.

Sophiisky II (6968): During the same year, on July the eighteenth, on Friday, at the second hour of the day, the sun lost its light and became as the eight day old moon; but one hour later it was full again and behaved as usual. (And again in the same chronicle) During the same year, on the twelfth of September, on Friday, at the second hour of the day, the light darkened, and one hour later it was all over.

Niconovsky (6968): During the same year and in the same month of June, on the eighteenth, on Friday, at the second hour of the day, the sun began to lose its light and became like the moon of the fifth day. When the fourth hour passed it was full again as before.

Voskresensky (6968): During the same year, on July the eighteenth, on Friday, at the second hour, the sun began to lose its light and was as the ten day old moon. But after the fourth hour it was full as before.

There is a similar record in the Simeonovsky chronicle. In Smolensk the phase was eight inches at 6: 12 A. M. This is very close to the estimate given in the Niconovsky. The phases quoted in the Sophiisky II and Voskresensky chronicles are greatly exaggerated unless the actual observation was made somewhere far in the north, which is improbable. The zone of totality moved from the Black Sea across the northern Caucasus and the northern part of the Caspian Sea. July 18, 1460 was actually on Friday, but so was September 12. The second report of the Sopiisky II could be explained by some atmospheric phenomenon but a few details

such as "the second hour" and the duration of about one hour should not be overlooked. It is more probable that both records of the Sophiisky II describe the same eclipse.

Partial eclipse of September 30, 1475 (6377)

Niconovsky (6984): During the same month of September, on the thirtieth, on Saturday, at the second hour of the day, a third of the sun lost its light and it became as a crescent with horns. In Moscow nobody saw it while in Kolomna and its vicinity many saw it.

[Kolomna is close to Moscow, only about 100 km. to the east] and the greatest phase of 2.87 inches occurred there at 7:32 A. M. As there is only a slight difference in the location of the two places, one must look elsewhere for an explanation of the lack of observation in Moscow; probably the reason was meteorological. This eclipse is remarkable for its small phase, which was less than three inches. In this respect it is second only to the eclipse which Hinsel found was recorded in the Arab chronicles. It was observed in Bagdad and its phase was only two inches. Hinsel supposes that it was noticed only because it was predicted. However, a similar explanation for the Kolomna eclipse is rather improbable. In 1475 September 30 was on Saturday; the year 6984 is recorded correctly if one takes into account that the chronicler counted the beginning of the year from September first.

Total eclipse of February 25, 1476 (6378)

Novgorodsky IV (6984): In the winter of the same year there was a sign during butter-week. There was darkness all over the country at the first hour of the day but only for a short time. Christian people were horrified, but soon it lightened up again, very quickly.

Pskovsky I (6984): During the same year, in butter-week, at the first and second hour of the day there was darkness and diminishing of the sun. (And again in the same chronicle) During the same month, on the 25th day, in butter-week, at the second hour of the day, as the sun was rising and people were going to markets and elsewhere in the town, it suddenly began to grow darker and the darkness lasted for a little while, less than an hour; people could not see one another on the market nor anywhere else in the town, and they were frightened; and again God gave us light as before.

Pskovsky II (6984): There was darkness all over the earth but it darkened for a short time only. Those standing even a short distance apart could not see one another. It happened during butter-week, before dinner. By means of such signs the Lord foretells various dangers to men.

Niconovsky (6984): About the diminishing of the sun, that is, about the darkness: during the same month, on the 25th, in butter-week, toward the end of the first hour, the sky was covered with clouds and the sun was not yet shining when

it began to darken, and it was as dark as in the second hour of the night. But after a short time the clouds in the south began to brighten and toward noon it was bright again as usual.

For Smolensk this eclipse was total. The totality took place at 7: 08 A. M. and the sun rose at 6: 43 A. M., only 25 minutes before the totality. The central zone passed through Riga, Smolensk and Moscow.

Partial eclipse of March 6, 1486 (6400)

Pskovsky I (6994): During the same year the sun lost its light for a short time only.

In Smolensk the phase was ten inches at 7: 12 A. M.; the greatest part of the eclipse was below the horizon because the sun rose that day at 6: 20 A. M.

Total eclipse of July 20, 1487 (6403)

Sophiisky II (6993): During the same year on the day of the Saint Elija, the sun lost its light.

The total eclipse which occurred on Saint Elija's day (July 20) was in 1487. The zone of totality passed from the north pole across Archangelsk, Veliki Ustug, Viatka and Kasan. In Smolensk the phase at 3: 32 P. M. was ten inches. [Obviously the year in the chronicle should read 6995.]

Annular eclipse of May 8, 1491 (6412)

Pskovsky I (6999): During the same year there was a sign in the sun.

This eclipse had for Smolensk a phase of 11.5 inches at 4: 24 P. M. The central zone passed through Mogilev, Briansk, Orel, Eletz and Voronezh.

Partial eclipse of August 20, 1533 (6509)

Sophiisky II (7041): During the same year, on the nineteenth of August, the sun lost its light between the first and the sixth hours of the day. (And a little further in the same chronicle.) At that time, on August the twentieth, on Wednesday, there was a sign in the sky. As the sun was rising at the second hour, its top appeared sliced off and the cut grew greater and greater until the third hour when about one third of the sun was gone and at one side of it there appeared something like the tips of a mustache. Then at the fifth hour it was full again just as it was before it all started. The sky was very clear, not a single cloud. The people after some deliberation decided it all prophesied some change among the ruling princes.

Shumilovsky (7041): During the same year '41 there was a sign in the sun and in the moon. When the sun rose at about the first hour of the day, surrounded by a bright cloud, darkness spread around. It was visible to everybody, but nobody knew where it came from because it was not like a cloud but just like

darkness. And all the sun disappeared for a long hour and did not let a single ray out for a long time, even up to the third hour and later. And the moon was seen in a cloud inside of three circles also for a long time, until the morning service was over.

This eclipse was partial for the earth in general. Its phase for Smolensk was four inches at 5: 44 A. M.

Total eclipse of April 7, 1540 (6524)

Pskovsky I (7048): On April the seventh, in the week after Easter, the sun lost its light. (The second copy of the same chronicle.) During the same year, on April the seventh, in the week after Easter, on Wednesday, there was a sign. The sun lost its light until the second hour and all this happened because our sins multiplied.

The phase of this eclipse for Smolensk was 11.5 inches at 6: 52 A. M. The zone of totality passed from Spitzbergen across the White Sea, then over Lake Onega, Novgorod, Vitebsk and Galicia.

Total eclipse of January 24, 1544 (6533)

Western-Russian chronicle: During the year of the Lord 1544 in the month of January on the 24th, on Thursday, about one hour before noon, there was a sign. Great darkness spread over just as if it were dusk and the sun became like a crescent, as a young moon with horns pointing to the west and then the horns turned to the east, and we saw two stars to the west of the sun, one white and one red. It all lasted about one hour and a half and then the darkness went away. This darkness came from the west.

The phase of this eclipse in Smolensk was eleven inches at 11: 16 A. M. The zone of totality passed over Finland, the bays of Finland and of Riga (near the island of Oesel), and towards Danzig. The two stars mentioned in the chronicle were Venus and Mercury; Venus was then in the maximum of its brightness and was very close to the horizon.

Annular eclipse of June 20, 1563 (6577)

Pskovsky I (7071): During the same year, on the twentieth of June, before the evening, there occurred a diminishing of the sun, as if the moon came under the sun. It was dark for only a short time, and it happened at the beginning of the birth of the moon.

This eclipse had for Smolensk a phase af ten inches at 6: 16 P. M. This record is very interesting because we find here for the first time a definite understanding of the real cause of an eclipse. Very probably it was an independent discovery of the chronicler who understood that the disappearance of the sun and the darkness was

simply the consequence of the superimposition of the lunar disk over the sun. Very remarkable also is the last sentence: "at the beginning of the birth of the moon". Here is a hint that soon after the eclipse the chronicler was able to find in the last rays of the sun the crescent of the new-born moon.

Annular-total eclipse of April 9, 1567 (6586)

Western-Russian: During the year 1567, in the month of April, on the fourth day, on Wednesday of the first week after Easter, all of the sun was darkened and then it became a crescent visible in the south with its horns toward the west.

Niconovsky (7075): On April the ninth there was the renovation of the moon; (the sun) lost its light at the eighth hour of the day and later, toward the eleventh hour, gradually filled up again, and it was very dark all this time. Everyone saw everything green and the sun was just as the young moon three days old.

Pskovsky I (7076): During the same year in the month of November there was a sign. After the time of the new moon there appeared two crescents with horns towards each other; one was a little higher, the other a little lower, and the man who noticed it did not see the end of it and did not know what happened in the end.

This eclipse had for Smolensk the phase of 9.5 inches at 5: 00 P. M. The sun set at 7: 07 P. M., soon after the end of the eclipse. The central zone passed through Crimea, to the northern shores of the Sea of Azov and then crossed the lower Volga. The observation recorded in the first of the three chronicles must have been made somewhere in southern Russia, where the phase was very great. If the expression, "all of the sun was darkened" is to be understood literally, the observer must have been in some place near Kherson or Taganrog. The third record relates the words of a third person and in this story there are two errors: first, in the year, and second, in the name of the month. These errors may be explained if we assume that the observer counted the year from the "Spring New Year", while the chronicler counted it from September first.

Doubtful solar eclipses

Annular eclipse of January 17, 1162 (5636)

Hypatievsky (6670): During the same year there was a sign in the sun, in the month of August, on the seventeenth day, on Thursday.

Actually a solar eclipse occurred on Wednesday, January 17. If we suppose that a solar eclipse was recorded and not some other phenomenon, then there must be an error in the day as well as in the month given in the chronicle. The seventeenth of August in 1161 fell on Thursday, and the seventeenth of August in 1162 fell on Friday, but there was no eclipse on either day.

Annular eclipse of January 30, 1283 (5939)

Niconovsky (6791): During the same year there was a terrifying sign in the sky.

It seems probable that this was the eclipse of 1283. In Smolensk it had a phase of 7.5 inches at 11: 12 A. M.

Total eclipse of June 26, 1424 (6263)

Novgorodsky I (6931): There was a sign in the sun.
Pskovsky I (6928): During the same year there was a sign in the sun in the month of July, on the sixteenth, in the tenth hour of the day.

There was no eclipse in 1423 but there was one next year, on the 26th of June.

II. Lunar eclipses

Partial eclipse of March 24, 1122 (3599)

Lavrientievsky (6630): There was a sign in the sun in the month of March on the tenth day, and in the moon during the same month on the 24th day.
Hypatievsky (6629): And there was a sign in the sun and in the moon in one and the same month.

Niconovsky gives the same record, but the date is March 20, instead of 24. The lunar eclipse followed the solar eclipse of March 10. The lunar eclipse had the phase of 3.5 inches and its duration was two hours, from 11: 43 P. M. till 1: 43 A. M. (P. M. T.)

Total eclipse of November 20, 1146 (3639)

Niconovsky (6654): During the same year there was a sign in the sky. The rays of the sun perished and the moon was bloody.

The phase of this eclipse was 21.1 inches. It started at 5: 08 A. M. (P. M. T.) and ended at 8: 52 A. M., after the sunrise, when the moon was already below the horizon.

Total eclipse of February 12, 1161 (3662)

Hypatievsky (6669): Izyaslav came to Kiev on February the twelfth and on entering the cathedral of St. Sophia proclaimed amnesty to all the inhabitants of Kiev. Then he went to Belgorod. At the same time there was a sign in the moon terrifying and wonderful. While the moon was moving across the sky from east to west it was changing its appearance all the time. First it diminished little by little until it all perished; its appearance was first very dull

or black and then bloody, and then it appeared as having two faces, one of them green and the other yellow, and in the middle of it were two warriors fighting with swords; blood was streaming from the head of one of them, something like milk was running from the other. Therefore, the elderly people said, this sign is not for good, but foretells the death of the prince, and so it happened.

The story about the opinion of the older people indicates that the record was made after the death of Prince Izyaslav, who was killed in the battle. This may explain how the original observation grew into such a fantastic picture. This eclipse occurred early in the morning and took place before the arrival of Izyaslav in Kiev. It started at 3: 02 A. M. (local time) when the moon was already in the southwest. The totality of 20.9 inches was reached at 4: 03 and ended at 4: 45. In spite of the early hour, it was observed by numerous people, because February 12 fell on Sunday and many were going to the morning services in churches.

Total eclipse of February 3, 1208 (3738)

Lavrentievsky (6715): During the same winter there was a sign in the moon, on February the third, the day of Saint Simeon. It was all darkened and what was left of it was like a crescent of the one day moon. This lasted from the evening up to midnight.

The eclipse was deeply total with a phase of 20.5 inches. It began at 6: 02 P. M. (P. M. T.), the maximum was reached at 7: 53, and it ended at 9: 44. The chronicler made a mistake when he said that it lasted up to midnight.

Total eclipse of June 7, 1248 (3800)

Niconovsky (6756): There was a sign in the moon; it was all bloody and lost its light. In the year Czar Batyi began to move his army.

The maximum phase of this eclipse was at 11: 11 P. M. (P. M. T.). The totality lasted one hour and eighten minutes and the phase was 15.6 inches.

Partial eclipse of December 1, 1259 (3818)

Novgorodsky I (6767): There was a sign in the moon, but it really was not a sign.

[This strange record can be tentatively explained by supposing that although something happened to the moon it could not be used as a portent.] The maximum of this eclipse was at 10: 19 P. M. (P. M. T.) and its phase was 8.6 inches.

Total eclipse of November 23, 1276 (3845)

Niconovsky (6784): In the same winter there was a sign in the moon in the month of November. It lost its light completely without a trace, and little by little it reappeared.

There is a similar record in the Simeonovsky. The eclipse started at 2:52 A. M. (P. M. T.) and ended at 6:32, almost one hour before sunrise. The totality lasted for one hour and 38 minutes and the phase was 19.4 inches.

Total eclipse of March 18, 1280 (3850)

Niconovsky (6787): There was a sign in the moon on the 24th of February. It lost its light completely and for a long time there was none of it. This occurred before dawn and the moon did not fill up until daylight. In the same winter there was a sign in the sun ... In the same year there was a sign in the moon during the night, it vanished completely and there was none of it up to dawn and when the day broke it had not yet filled up completely.

There was no lunar eclipse on the 24th of February in either 1279 or any other year closely preceding or following. There was a total eclipse on March 18, 1280 and it is very probable that this was what was recorded here. Obviously the same phenomenon is described twice in almost identical words but possibly obtained from different sources. The eclipse had the phase of 20.6 inches and the maximum phase occurred at 2:43 A. M. (P. M. T.); the end of totality was at 3:34 and the end of the partial eclipse at 4:35. The sign in the sun mentioned in the chronicle was not an eclipse.

Partial eclipse of December 24, 1284 (3858)

Pskovsky I (6792): There was a sign in the moon, on December 24th, on Sunday. Two weeks later, in January, on the twelfth, a calamity happened; the Germans massacred the people of Pskov, and killed forty men at Alyst. Just as the old chroniclers tell us, such signs are not for good but always foretell evil.

The phase of this eclipse was 9.7 inches. It began at 4:10 A. M. (P. M. T.), the maximum was at 5:42 and the end at 7:14. The massacre of Pskov is recorded in the Pskovsky II under the date of January 2.

Total eclipse of February 14, 1291 (3868)

Suzdalsky (6798): During the same year there was a sign in the moon. It was like blood and then changed into darkness.

The Niconovsky chronicle records the same event under the year 6799. The phase of this eclipse was 19.5 inches and its maximum occurred at 12:22 A. M. (P. M. T.).

Total eclipse of October 2, 1316 (3911)

Niconovsky (6824): During the same year the moon lost its light before the early dawn and went down still not filled up.

This eclipse had a phase of 17.6 inches and its maximum occurred at 4:18 A. M. (P. M. T.); the end of totality was at 5:04 and the partial eclipse ended at 6:08. The eclipse ended at the moment when the moon was setting.

Total eclipse of November 23, 1360 (3977)

Novgorodsky I (6868): In the same year there was a sign in the moon, during the Philip's Lent, as if it became covered with dark blood on a clear sky.

An identical record is found in the Novgorodsky II and Voskresensky. This eclipse began at 3:09 P. M. (P. M. T.). The sun set around 4:00 P. M. local time; thus both the maximum at 4:52 and the end of the eclipse at 6:35 could be observed very easily. The phase was 13.5 inches, and the duration of totality was 54 minutes.

Probably the same eclipse is recorded as follows:

Niconovsky (6869): There was a sign in the sky. The moon lost its light and was as blood. (And again in the same chronicle, in connection with a solar eclipse.) During the same year there was a sign in the sky. The sun lost its light and then the moon changed into blood.

The solar eclipse occurred on May 5, 1361, but there was no lunar eclipse in that year. Apparently the word "then" does not connote "later".

Total eclipse of December 4, 1378 (4002)

Niconovsky (6887): A sign. In the same winter, during the Philip's Lent, in the month of December, on the fifth day, on Sunday, in the early dawn, there was a sign in the sky. The moon darkened and turned into blood, and stood still in one place and after this it brightened up from the south side but remained dark on the east side; and then it returned into light again.

This eclipse began at 11:47 P. M. (P. M. T.) and ended at 3:13 A. M. The duration of totality was 54 minutes and the phase was 13.5 inches. The astronomical dawn began at 6:30 A. M. and the words "in the early dawn" are not very accurate.

Total eclipse of May 10, 1389 (4018)

Niconovsky (6897): During the same spring, in the month of May, on the tenth day, in the evening dusk, the moon lost its light and for a long while there was none of it left; and it appeared again before the early dawn.

This eclipse had a phase of 16.0 inches. It began at 6:55 P. M. (P. M. T.) and ended at 10:29. The duration of totality was one hour and 22 minutes. In Novgorod at that time of the year the twilight lasts through the night and therefore it was quite natural for the chronicler to say that the eclipse ended before the early dawn. In Kiev such a statement would not be correct.

Total eclipse of September 2, 1392 (4023)

Niconovsky (6901): In the month of September, on the first day, the moon lost its light before the early dawn.

This eclipse began at 2: 55 A. M. (P. M. T.) and ended at 6: 27. The totality lasted for one hour and twelve minutes and the phase was 15.1 inches.

Total eclipse of October 27, 1395 (4027)

Niconovsky (6904): During the same winter, in the month of December, on the 27th day, at the seventh hour of the night, the moon lost its light and was like blood.

This eclipse began at 12: 07 A. M. (P. M. T.); the maximum was at 1: 53 A. M., the end at 3: 39 A. M., and the phase was 15.1 inches. The seventh hour of the night corresponds to the local time between midnight and 1: 00 A. M.

Total eclipse of April 20, 1399 (4032)

Niconovsky (6906): In the month of September the moon darkened in the fourth hour of the night. And for a long time there was none of it left and therefore it was very dark.

The eclipse of September 26, 1398 had a phase of only 0.5 and its maximum occurred at 2: 20 A. M. (local time). The eclipse of September 15, 1399 was not visible in Russia. Therefore the eclipse recorded here must be the eclipse of April 20, 1399. Its maximum was at 9: 46 P. M. (local time) which closely corresponded to the church fourth hour. Its phase was 13.4 inches, its duration was three hours and 26 minutes, and the duration of the totality was 52 minutes. The error in the name of the month may probably be traced to the confusion created by the custom of counting the "Church Year" from September 1, while still retaining the earlier "Spring Year" which began in March.

Total eclipse of August 2, 1403 (4939)

Pskovsky I (6912): During the same summer there was a sign in the moon, on the second of August, the day of the Saint Martyr Stephen, at the sixth hour of the night.

This eclipse began at 10: 44 P. M. (P. M. T.), its maximum was at 12: 34 A. M., and it ended at 2: 24 A. M. The phase was 19.1 inches. The sixth hour probably marks the beginning of the eclipse.

Partial eclipse of June 2, 1406 (4043)

Sophiisky (6914): During the same year the moon lost its light before the morning dawn and blood appeared in its place. It went down before it brightened up.

Niconovsky (6914): In the same year, on Tuesday before Saint Peter's Lent, the moon lost its light before the early dawn and it set before it brightened up.

The eclipse began at 1: 08 A. M. (P. M. T.) and ended at 4: 10 A. M.; its phase was 9.5 inches. The sun rises in Novgorod on that day at 3: 00 A. M. (local time) and in Kiev at 3: 55. Thus the moon set "before it brightened up".

Total eclipse of May 22, 1407 (4045)

Niconovsky (6915): During the same year, on the 25th day of the month of May, the moon lost its light in the early dawn, all of it, and thus it set.

The phase of the eclipse was 17.9 inches. It began at 1:23 A. M. (P. M. T.), the maximum was reached at 3:13 A. M., the total phase ended at 4:00 A. M., and the eclipse ended at 5:04 A. M. The sun rose in Novgorod at 3:11 A. M. (local time); at that time the moon was low in the west and deep in the shadow.

Partial eclipse of July 24, 1431 (4082)

Pskovsky I (6939): During the same year, on the 24th of July, at the fifth hour of the night, there was a sign in the moon about midnight.

The phase of the eclipse was 4.8 inches. It began at 12:04 A. M. (P. M. T.) and it ended at 2:24 A. M.

Total eclipse of January 17, 1432 (4083)

Pskovsky I (6940): There was a sign in the moon on the seventeenth day of January

This eclipse began at 4:40 P. M. (P. M. T.) when the sun had already set, and it lasted until 8:12 P. M. The phase was 15.1 inches and the duration of the totality was one hour and twelve minutes.

Total eclipse of January 6, 1433 (4085)

Pskovsky I (6940): During the same year, in winter, on the fifth of January, at night, there was a sign in the moon, at the seventh hour of the night.

Pskovsky I (6941): In that winter there was a sign in the moon, on the sixth of January, at the seventh hour of the night.

The same record is found in Pskovsky II. The eclipse occurred on January 6, 1433. Its phase was 13.9 inches, and it began at 1:53 A. M. (P. M. T.), the chronicler's seventh hour, and ended at 5:21 A. M. The duration of totality was just one hour.

Partial eclipse of July 3, 1460 (4124)

Pskovsky I (6968): During the same year, on the third of July, there was a diminishing of the moon.

Niconovsky (6968): In the same month the moon lost its light during the night.

The lunar eclipse occurred before the solar eclipse but it belonged to the same lunation. Its phase was only 3.6 inches but nevertheless it was noticed and recorded. It began at 8:58 P. M. (P. M. T.), almost simultaneously with sunset and ended at 11:00 P. M.

Total eclipse of December 17, 1461 (4127)

Novgorodsky IV (6970): In the month of December, during the night, the moon lost all its light. The sky was clear and at the beginning the moon was full and bright and then on the same night it brightened up again.

Avrahamka (6970): In the same month of December, on the seventeenth, on the day of the Saint Prophet Daniel, from the fifth to the twelfth hour, by the will of God, the moon changed into darkness, and those who saw it were in terror and said, "Glory to Thee, Oh Christ, who showest this to us!"

The eclipse began at 3:09 P.M. (P.M.T.) and ended at 6:39. The phase was 14.5 inches and the duration of this totality was one hour and eight minutes. The recording of the beginning of the eclipse at the fifth hour was probably a guess because when it began the moon was still below the horizon and the setting sun was still shining.

Total eclipse of October 4, 1465 (4131)

Niconovsky (6974): On the fifth day of October, at the first hour of the night, the moon lost all its light for two hours.

The phase of the eclipse was 16.7 inches; it began at 4:31 P.M. (P.M.T.), and ended at 8:07. Its duration was three hours and 36 minutes and the duration of the totality, one hour and 26 minutes. The date recorded is in error by just one day.

Total eclipse of November 27, 1471 (4141)

Novgorodsky IV (6979): During the same autumn, on November 27, the moon lost its light. About midnight in a clear sky it appeared as if there was blood over the moon; darkness lasted for quite a time, and then it gradually brightened up.

The phase of this eclipse was 14.0 inches. It began at 8:54 P.M. (P.M.T.) and ended at 12:18 A.M. The duration of the totality was one hour and one minute. The chronicler points out that the sky was clear but in spite of this the color of the moon was bloody.

Total eclipse of March 10, 1476 (4148)

Niconovsky (6984): In the month of March, on the tenth day, but of the celestial February on the fifteenth, during the night from Sunday to Monday, in the third hour, the moon began to lose its light and lost all of it. Up to midnight nothing was seen of it, and later it appeared again.

The phase of this eclipse was 13.5 inches. It began at 6:42 P.M. (P.M.T.) and ended at 10:08. The duration of totality was 54 minutes. The maximum occurred at 8:25, and the third hour given in the record corresponds to the middle of the eclipse. The full moon was referred to the "Celestial February" because fifteen days passed from the "birth of the moon in February".

Total eclipse of September 3, 1477 (4149)

Niconovsky (6985): In the month of September, on the third day, during the night, the moon lost its light. It was the August full moon.

The eclipse began at 11: 48 P. M. (P. M. T.) and ended at 2: 20 A. M.; its phase was 15.5 inches. The duration of totality was one hour and sixteen minutes.

Partial eclipse of November 27, 1536 (4237)

Sophiisky II (7045): During the same autumn, on the 27th of November, in the first hour of the night from Monday to Tuesday, there was a sign in the moon. When it rose in a cloud at first it showed itself as usual, and then little by little it began to get darker and finally it became bloody. Very little was left of the bright moon, less than the fifth part of it, and this continued for about one hour and a half. Then by God's will it began slowly to reestablish its brightness.

The eclipse lasted from 5: 37 P. M. (P. M. T.) until 8: 45 P. M. The duration recorded in the chronicle probably refers to the greatest phase, of 10.4 inches, which left for the bright portion only 1.6 inches. The sun set that day in Moscow at 3: 24 P. M. (local time), and at that time the full moon appeared in the east "as usual".

Total eclipse of October 28, 1566 (4283)

Western-Russian: In the year of our Lord 1566, on the 28th day of October, the day of Saints Simon and Judah, on Tuesday, there occurred a sign in the sky on the moon. The moon became as blood and thus remained for three hours.

Pskovsky I (7075): In the same autumn there was a sign in Yuriev-Livonsky (now Tartu in Estonia). Two moons appeared in the sky at night, and they struck at each other, and one moon tore off the tail of the other. That moon pulled its broken tail back to it, and this became visible on that moon like a belt.

The phase of this eclipse was 18.6 inches. It began at 3: 40 P. M. (P. M. T.), its maximum was at 5: 30 and the end at 7: 20 P. M. The totality lasted for one hour and 36 minutes. In Yuriev the eclipse started at 3: 24 P. M. (local time); as the sun was setting at that latitude at 3: 50, the eclipse had already begun before the rising of the moon.

Doubtful lunar eclipses

Total eclipse of March 15, 1150 (3644)

Novgorodsky I (6657): During the same night there was a sign in the moon. It perished completely, but towards dawn became full. This was in February.

In the month of February there were no eclipses in any of the years 1148 to 1151. But in 1150 there was a total eclipse in March whose phase was 21.8 inches.

Partial eclipse of August 18, 1160 (3661),
or *Total eclipse of August 7, 1161 (3663)*

Hypatievsky (6669): During the same year there was a sign in the moon. It perished completely in the month of August on the twentieth day.

The eclipse of August 18, 1160 had a phase of only 7.2 inches, and was far from being total, while the chronicler says positively that "it perished completely". There was a total eclipse in August of 1161, but it occurred on the seventh. We may assume that the writer observed both eclipses but made his records later, and remembering the total eclipse more vividly got mixed up on the dates.

Total eclipse of December 22, 1200 (3727)

Lavrentievsky (6709): During the same winter there was a sign in the moon in the month of December on the 24th day, the day of the Saint Martyr Eugenia. The Princess of the House of Yaroslav, the wife of the Grand Prince Vsevolod, died the next morning.

In 1202 there was no eclipse in December. That of December 11, 1201 was not visible in Russia. An eclipse occurred on December 22, 1200 and its phase was 20.7 inches. If the date is recorded incorrectly, the error cannot be ascribed to a mistake of a copyist, because the chronicler indicates that the eclipse took place on the day of Saint Eugenia, whose memory is celebrated on December 24.

III. Comets

[The identification of comets observed in medieval times is seldom quite certain; for this reason no attempt has been made here to separate doubtful records from more definite ones. During the period we are concerned with, Halley's Comet passed through perihelion seven times; of these, the Russian Chronicles record five appearances. The approach of the comet in 1456 was missed because it occurred in the summer time when twilight lasts throughout the night in most of Russia. And there is one uncertain record which may be identified with the comet's passage in 1378. The portions of the Lavrentievsky Chronicle copied from Byzantine sources mention the appearance of Halley's Comet in 163 B. C. and A. D. 66, 530 and 912.]

The comet of 1028 (?)

Lavrentievsky (6536): A sign appeared in the sky; it was seen all over the land.

In some of the later copies the words "like a serpent" are found. In the Tverskoy chronicle such a record appears under the year 6535. There is a possibility that simply a meteor was recorded; however, the statement that the sign was seen "all over the land" favors a description of a comet. Pingré (Cometographie, Paris, 1783)

has two short notices; "a comet in 1027" and "a star moved from the west to the east on October 31, 1029".

Halley's comet of March 27, 1066

Lavrentievsky (6572): About this time there was a sign in the west. A very great star with bloody rays was rising in the evening after sunset and it remained there for seven days. This appearance was not for good. After it there was much civil strife and an invasion of the Russian land by infidels. It all happened because the star was a bloody one and foretold bloodshed.

In the chronicle of Avrahamka this phenomenon is recorded much more briefly but also under the year 6572. In the Novgorodsky I and in the Gustinsky it is recorded under 6573. It is the same appearance of Halley's comet which is associated with the Norman invasion of England.

The comet of 1106 (?)

Hypatievsky (6613): During the same year a star with a tail appeared in the west and remained there for a month.

Pingré mentions a comet which appeared in the west in 1105 during the month of February, and another one which was visible in February and March of 1106. This last one was observed in Constantinople, Jerusalem and China.

Halley's comet of April 29, 1145

Hypatievsky (6653): Vsevolod sent for his brothers Igor and Sviatoslav, and for Volodimir and Izyaslav Davidovichi, and they came to Kiev. And then a very great star appeared in the west letting forth rays.

Unfortunately after these words there is an illegible place in the text where possibly there was a more detailed description of the comet. In its 1145 appearance Halley's comet was a morning star until the middle of May, and only after May 14 did it appear in the west. [The observation must have been made in the vicinity of Kiev: farther north the summer twilight would have made it impossible.]

Halley's comet of September 15, 1222

Lavrentievsky (6731): During the same year there appeared a star in the west; rays were coming from it not toward the people but toward the south; two rays appeared from it as it was rising in the west after sunset, and it was more magnificent than any other stars. And it was like this for seven days; and after that the rays went from it towards the east. This lasted for four days and than it became invisible.

Novgorodsky IV (6732): There appeared a star and it was called "dokit", which means a spear, because it spread from east to west like a spear and remained there for seventeen days.

Similar records are found in the Voskresensky and Niconovsky under the year 6731 and again in the Niconovsky but under the year 6733. The record of the Novgorodsky IV, which probably refers to the same comet must have been taken from Byzantine sources since "dokit" appears to be the Greek word δοκος.

The comet of July 19, 1264

Hypatievsky (6773): A star with a tail appeared in the east and it was horrible even to look at it. It let out long rays, and it was called a "hairy star". Seeing it men were stricken with terror and fright. The wise men looked at it and said a great riot will break out all over the country. But the will of God saved his people and nothing happened.

Gustinsky (6772): There appeared a terrifying star. It was shining for more than three months, and let out rays which reached the noon part of the sky.

In 1264 a comet was observed in many localities, and it was described accurately enough to make it possible to compute its orbit. The Volynsky chronicle repeats the Hypatievsky account but the year is given as A. D. 1264. Similar versions are found in the Khlebnikovsky and Ermolaevsky copies.

The comet of 1266 (?)

Gustinsky (6774): During the same winter a star with a tail was visible during thirteen nights.

Tverskoy (6774): During the same winter a star appeared in the west and it had a long ray like a tail which was directed toward noon. It remained there for thirteen nights and after this it became invisible.

There is no record of this comet in any of the Western chronicles. The very definite description given by the Russian chroniclers, i. e. its place, duration of visibility, the inclination of its tail toward the south, makes it pretty certain that it was a comet. It is very unlikely that this was the comet of 1264, because the circumstances of the appearance of the two comets are entirely different. Similarly, it is impossible to identify it with the bright comet of 1265 or with the doubtful one of 1266.

Halley's comet of October 22, 1301

Lavrentievsky (6810): During the same year, in autumn, there appeared a star in the west, with rays which looked like a tail turned upwards, while its face was turned toward the south.

Niconovsky (6810): During the same year there was a sign in the sky. There appeared a star in the west which was letting out rays upwards like a tail, but its lower part was directed toward the south.

Gustinsky (6810): There appeared a terrible star which shone brightly in the west and let out rays.

All these records were obviously dated according to the September year. During the month of September the comet was moving over the constellation of Ursa Major, and in October it was first visible in the north-west and then in the west. There it was noticed by the Russian chroniclers.

The comet of October 13, 1366

Simeonovsky (6875): During the same autumn and in the following winter there appeared a star in the shape of a spear, and everybody could see it for many evenings. This apparition is not without significance and it is not for good.

Voskresensky (6875): During the same autumn and winter there appeared a star with a tail.

Avrahamka (6876): There appeared a star with a tail.

Novgorodsky IV (6876): There appeared a star with a tail and in autumn Prince Dmitri Ivanovich undertook an expedition against Tver.

Niconovsky (6876): During the same year there appeared a star with a tail.

According to Chinese sources there was a comet in 1366 which passed through perihelion on October 13.*

Halley's comet of November 8, 1378 (?)

Novgorodsky IV (6890): There was a portent or a sign which appeared in the sky for several nights. In the east, before dawn, a certain star appeared with a tail in the shape of a spear. Then it was visible in the evening dusk, and then again in the morning dawn. This happened several times. This sign foretold the invasion of the Russian land by the Khan Tokhtamysh and the vicious attack on the Christians by the infidels, the Tartars.

Tverskoy (6890): During the same winter a sign appeared in the east.

Voskresensky (6889): During the same winter and spring there appeared a sign in the sky. In the east before dawn there was a pillar of fire and a star in the shape of a spear.

The Pskovsky I gives a similar record under the year 6890, while the Niconovsky places it under 6889. The destruction of Moscow by the Tartars occurred in 1382. A bright comet was probably observed a few years before that, or even before the battle of Kulikovo in 1380. But that time nobody paid much attention to the comet, especially because the battle of Kulikovo was disastrous for the Tartars. Two years later, after the sacking of Moscow, people remembered the comet and the writer decided that it would be appropriate to begin his story with a description of a heavenly sign.

The comet of 1402

Novgorodsky I (6910): There appeared a sign in the sky, a star with a tail; it had a bright ray and remained in the west during the whole month of March.

* This date comes from the orbit by Peirce, whereas the perihelion of Hind's orbit is on October 21.

Novgorodsky IV (6910): During Lent, in the month of March, there appeared a certain sign in the sky. There was a star in the west, in the evening dusk, not a small one, in the shape of a spear, and above it there was a ray shining. It was rising in the east, but later appeared in the summer west. We all saw it thus rising the whole month.

Sophiisky II (6910): In the month of March, in the evening dusk, in the west, there appeared a great star in the shape of a spear, and upward from it extended a ray. It rose in the east and appeared again in the west for twelve days.

Voskresensky (6910): A sign. In the year 6910, in the month of March, there appeared in the dusk a big star, spear-shaped, and above it there was shining a ray. It was rising in the east and also appeared in the west. We saw it during twelve days thus rising and shining.

Niconovsky (6910): A sign. In the same winter, during Lent, in the month of March, there appeared a sign in the west in the evening dusk. A very great star, spear-shaped, and above it a long ray, was visible. We saw it for twelve days rising in the east and also shining in the dusk in the summer west. This is what this sign foretold: various nations began to fight each other.

Pskovsky I (6911): There appeared a star with a tail in the west in the month of February, and disappeared in the month of March on Palm Saturday.

Pskovsky II (6911): There appeared a star with a tail in the west and it rose with the other stars from the days before Lent up to Palm Sunday, and then it disappeared.

Supralsky (6910): During the Great Fasting in the month of March, there was a sign in the sky in the evening dusk. In the west a large spear-shaped star appeared. A ray shone upward from it, and it rose in the east, and then it was visible in the summer west. We saw it during the whole duration of the Great Lent. On Good Friday the star moved during the day across the sun; we all saw it moving.

The western sources show that a comet appeared in 1402; it was observed in Russia from the end of January up to March 18 (Palm Saturday), and thus was visible during two months. The Russian chroniclers confirm the seemingly paradoxical records of the western observers, that the comet was visible both in the east and in the west during the same nights. Owing to its unusual brightness the comet was seen even in the daylight.

The comet of 1462 (?)

Gustinsky (6970): There appeared in Poland a terrifying sign. After sunset there was visible in the sky a crucifix with a sword. It moved for more than two hours between noon and the west.

Pingré, under the year 1461, says briefly "a comet", but under 1462 no comet is mentioned at all. In 1463 a comet was observed in China in the spring, in the constellations of Virgo and Leo.

The comets of 1468

Gustinsky (6976): There appeared two terrible stars one after the other.

Two comets were observed in 1468. The first one was recorded in China in February in Ursa Major, and the second was visible from September to November. The orbit of this last comet was computed and the perihelion passage was found to have occurred on the seventh of October.

The comet of February 18, 1472

Novgorodsky IV (6980): During the same winter, after Christmas, there appeared a great star and from it a ray was coming forth, very thick and bright, brighter than the star itself. It was rising about the sixth hour of the night, where the summer sunrise is, and then it moved to the summer west, and its ray was moving in front of it and the end of the tail was spread like a bird's tail. In the month of January another star with a tail appeared above the summer west; its tail was thin and not very long and reached at its end up to the other star. But the second star had darker rays. The first star appeared on its place three hours before sunrise, and the other star appeared for the same number of hours on its place after sunset.

Sophiisky II (6980): During the same winter a spear-shaped star which was called a tailed star appeared in the sky. It was visible in the east, and the rays from it spread toward the west. It was there for many days and vanished. And another one appeared in the west spreading its rays toward the east.

Pskovsky I (6980): There appeared a star with a tail in the sky. (And a little farther on in the same chronicle.) During the same month of January a star with a tail appeared and it was there all through the month of January and for about a week in February, and then disappeared. The motion of this star was very surprising; its hair sometimes was in front of it, and sometimes behind, and the motion it had was not like the motion of the other stars, but it moved where it wished, sometimes toward noon, sometimes toward midnight. Sometimes it looked pale, also its hair was sometimes short, and again long and bright. All this was visible in all countries, not only in Russia, but in the land of the Germans too.

Pskovsky II (6980): There appeared a star in the sky and spread itself, letting out bright rays like a tail.

Gustinsky (6980): A terrible star appeared, letting out rays, and remained for more than two months.

Novgorodsky IV (6979): During the same winter there appeared a star with a tail; it had a bright ray, a very long one when visible on a clear sky, and the star itself was very large and it was here for many months. It disappeared in February.

The first five records apparently used the "September Year", while the last one, which gives the account under the year 6979, was probably copied from some other

source which used the "Spring Year". The comet was recorded several times in the Western Annals, and Regiomontanus obtained comparatively accurate positions of it. These observations made it possible for Halley to compute the comet's orbit and its perihelion passage.

The comet of December 24, 1490

Novgorodsky IV (6999): On the night of January ninth, from Sunday to Monday, in the second hour of the night, there appeared in the sky, in the west, a star with a tail, but its tail was directed toward the east and was fourteen feet long. It remained visible till the sixth hour of the night.

Almost identical records are found in the Niconovsky and Voskresensky chronicles.

Gustinsky (7000): King Kasimir died in June and his son Jan Olbracht became King. Kasimir's death was foretold by heavenly signs. About the full moon of December, there appeared three suns about noon time, and then a terrifying star shone after sunset for more than two months.

The Novgorodsky IV undoubtedly refers to the comet of 1490, which was well observed in China. Hind computed its orbit and the perihelion passage.

The comet of 1500

Gustinsky (7007): (After the story of the battle of Czar Ivan Vasilievich with Alexander of Lithuania and the invasion of that country by the Tartars in September.) These calamities were foretold by various signs. Among other things, there was an unusual star, which was called a comet; it shone for eighteen days before the above mentioned events.

It is worth noticing that the Gustinsky chronicle uses here the word "comet". This comet was very bright, and according to Pingré (l. c.) and Arago (Astronomie Populaire) was given the name of "Great Asta" *Le Seigneur Astone.*

The comet of 1520 (?)

Pskovsky I (7028): There was a sign in the sky. A very bright star with a tail appeared in the north.

In 1520 there is just one vague record of a comet in the Western European Annals. The Russian observation may have been just a meteor. Pingré mentions comets in 1518 and 1521.

Halley's comet of August 26, 1531

Voskresensky (7039): During the same year, in August, a great star appeared above the summer sunrise during many morning dawns. A long ray was shining from

it upwards. It did not follow a usual path but went toward the midnight countries and later in the same month the same star appeared in the evening dusk after sunset. It was red and the ray shining from it upwards was also red and was spreading above the summer sunset.

In China the comet was observed for three weeks before it passed through perihelion. The comet was then in the constellation of Gemini, and then moved across Ursa Major and Coma Berenices.

The comet of October 19, 1532

Voskresensky (7041): During the same autumn, in October, there appeared a star in the morning dawn, two hours before daylight, above the winter sunrise. It had a ray which was shining very brightly, was very wide, and was directed toward noon. It appeared in the same spot from October 1 until November 9.

A similar record under the same year is found in the Niconovsky chronicle. The elements and perihelion passage were computed independently by Halley and by Olbers. Pingré says that the comet was observed between October 2 and November 8; these dates agree very closely with those given in the chronicle. The daily motion of the comet in that period was very small.

The comet of June 14, 1533

Voskresensky (7041): During the same summer, in July, there appeared a star in the fourth hour of the night above the suburb of the glorious city of Moscow. It was visible between the churches of the prophet Elija and of Epiphany, behind the market place. It was not large, neither did it shine brightly, but a ray was coming from it, long and wide, toward the winter east: and it could be seen for many nights.

Sophiisky II (7041): During the same year, in the city of Great Novgorod, a great bright star appeared in the sky. A long ray extended from it toward the noon, and it appeared in the morning dawn in the east and sometimes in the evening twilight. The bright and long ray was like flame; it appeared many times, not less than for thirty days. Some people saw this star even for more than thirty days, and it disappeared after that. Some Orthodox Christians told the Archbishop that in Pskov, in the year thirty and nine, a star like this one appeared for many days and also disappeared afterwards.

It is known from the Western European and Chinese records that the comet appeared toward the end of June in the constellation of Taurus and moved during the month of July across Cassiopeia and Cygnus. The comet about which the Pskovichi spoke to the Archbishop was Halley's comet in its return of 1531.

The comet of April 22, 1556

Pskovsky (7064): In the month of March there appeared a spear-shaped star from the warm wind, between the noon and the west, and during the night moved toward the east, and then advanced little by little toward the north, all through the month of March.

Niconovsky (7064): During the same winter, during Lent, there was a sign in the sky. A star with a tail was rising from the east, with its tail toward the west, and it was there for about two weeks.

Dvinsky (1556): During the same winter, at the time of Lent, there appeared a star with a tail and was visible for two weeks.

This comet, according to the observations of Fabricius, appeared in the constellation of Virgo. Then it moved across the constellations of Bootes, Draco, Perseus and Andromeda. In 1556 Easter fell on April 5, and consequently Lent began on February 17. [In the Greek Orthodox Church Lent begins on Monday and not on Wednesday.]

The comet of November 28, 1580

Pskovsky I (7088): There appeared a sign, a spear-shaped star.

This comet was observed by Tycho Brahe and by Moestlin, and its orbit was calculated later by Pingré and by Halley. The length of the tail was less than three degrees and at perihelion the comet was rather far from the sun. It was faint, and it is surprising that it was recorded by the chroniclers.

IV. Auroras, fireballs and meteor showers

Fireball of 1091

Lavrentievsky (6599): During the same year Prince Vsevolod was hunting big game near Vyshgorod. As the nets were ready and the criers began to shout, an enormous serpent fell down from the sky and everybody was terrified. At the same time, many heard several thumps in the ground.

Gustinsky (6599): During the same summer the earth groaned.

Pskovsky I repeats the Lavrentievsky record but under the year 6596. The last record led to the opinion that it was an earthquake. However, the first record definitely speaks of a falling meteorite.

Aurora in 1102

Lavrentievsky (6610): During this year there was a sign in the sky, in the month of January, on the 29th, and it lasted three days. A glow of a big fire was

visible in the east, south, west and north, and the light continued through the night, as if a full moon were shining.

Similar records are found in the Niconovsky and Voskresensky chronicles.

Fireball of February 11, 1110

Lavrentievsky (6618): During the same year there was a sign on the eleventh of February. It was seen at the Crypt Monastery near Kiev. A fiery pillar appeared which extended from the earth to the sky and the lightning illuminated all the country, and it thundered in the sky in the first hour of the night. And everybody saw that at first the pillar stood above the stone building of the refectory, so that the cross on that building was not visible; and after a little while it moved over to the church and stood above the grave of Theodosius, and then moved upwards and faced the east and then became invisible.

The best possible explanation of this phenomenon is that it was a luminous train of a huge fireball which passed over Kiev in the evening, around six or seven o'clock.

Fireball of 1144

Hypatievsky (6652): There was a sign across the river Dniepr, in the vicinity of Kiev. Something like a fiery circle flew across the sky toward the earth and in its place a sign was left like a great serpent. It remained in the sky for one daylight hour, and then gradually disappeared.

This is the only place in the chronicles that may be interpreted as an indication that the Russians of that time used "horae inequales", that is, that both the day and the night actually contained twelve hours. In such case the hour becomes indeterminate and depends on the time of the year.

Aurora and the Leonids of October 18, 1202

Lavrentievsky (6711): During the same winter there were many signs in the sky but we shall describe only the following. It occurred in the fifth hour of the night that the whole sky began to run and became red, and to the men who saw it, it seemed as if blood was spilled over the snow that covered the ground and the house roofs. And some people saw the streaming of the stars in the sky; the stars tore themselves off and fell toward the earth. The witnesses thought it was the end of everything. All these signs, either in the sky, or in the stars, or in the sun, or in the moon, or anywhere else, are not for good. They foretell evil, either wars or famine or somebody's death.

Tverskoy (6711): During the same winter there was a sign. On February the sixteenth, in the fifth hour of the night, the sky began to run and it was red. The snow on the ground and on the houses looked as if blood was spilled over it and many stars tore themselves off the sky.

The Pskovsky I and Voskresensky chronicles give the same record under the year 6710, but the Lavrentievsky probably gave the date counted according to the "September Year". The date of February 16 in the Tverskoy probably refers to the aurora and not the meteor shower.

Fireball of 1215

Novgorodsky (6722): In the month of February, on the first day, the Sunday of butter-week, there was thunder during the early morning service, and everybody heard it, and soon after that they saw a flying serpent.

We may assume that the "Spring Year" was used in this record, since the first of February fell on Sunday in 1215 but not in 1214. However, the Sunday of butter-week fell that year on the first of March.

Aurora of 1242

Tverskoy (6751): (After the story of the battle of Prince Alexander on the ice of Lake Chudskoye on the fifth of April, on Saturday of the fifth week of Lent, there is the following passage.) This I heard from an eyewitness who said, "I saw God's army in the air which came to help Alexander, and many other true-believers saw these regiments helping Alexander."

Aurora of 1269

Gustinsky (6777): Great wonders. People saw an army fully equipped in the sky; it was divided into two parts which fought one another. During the same year in the night of December 6, a light appeared in the sky in the shape of a cross, and illuminated not only the town but all the surrounding country as well.

[It requires little imagination to see in certain auroras the flashing spears and waving banners of a medieval army.]

Fireball of 1280

Niconovsky (6788): During the same year there was a sign in the sky. A fiery cloud appeared in the west, and sparks fell from it to the ground. It remained visible for a little while and then disappeared.

Aurora of 1292

Niconovsky (6800): During the same year there were terrifying signs in the sky. Something like an army stood in the air in the night, in the south as well as in the north.

Aurora of 1370

Lavrentievsky (6878): There were signs for many nights. The sky was bloody and pillars stood over the sky.

Niconovsky (6879): A terrible sign. During the autumn there were many signs in the sky. For many nights people saw pillars in the sky and the sky itself was red, as if covered with blood. So red was the sky that even on the earth covered with snow all seemed red like blood, and this happened many times. Even before the snow fell all appeared as if blood were on the ground, on the buildings and on the water. And when the snow covered the ground it appeared red as blood and all men walked about as if covered with blood. But when one would come under a roof or enter in a room there would be nothing red on him any more. All these events foretell a great sorrow which is about to happen, of invasions by the enemies and bloodshed of civil strife. This actually happened later.

Sunspots were observed according to Russian Chronicles in 1371, and according to Chinese records in 1370.

Aurora of 1401

Niconovsky (6909): During the same year, in the month of August, in the night, on the eve of the Assumption of Our Lady, from midnight until daylight, pillars appeared, and their upper ends were like blood; it was very frightening to see it.

Aurora of 1402 (?)

Niconovsky (6911): During the same autumn, in the month of October, on the tenth, there appeared a sign in the sky in the second hour of the night. It was a very large fiery spear and it appeared three times.

The phenomenon was observed in the evening at about seven or eight o'clock, when it became sufficiently dark. The Western Annals do not record a comet in 1403; according to Pingré there was a comet in 1402 which was observed until the middle of September.

Fireball of December 8, 1411

Niconovsky (6920): During the same winter, on the eighth day of December, Prince Vasily Mikhailovich was staying in his estate Strazhnevo, and while they were in church on the day of the Immaculate Conception attending the evening service, a very large and terrible serpent came flying from the town of Kashin. It was belching flames and flew from east to west toward a lake. It was as bright as the sunset and Prince Vasily and all his nobles and all the people in the villages around the town saw it. And they all saw it at the same time.

The appearance of the fireball occurred around 4:00 P. M., when in winter time it is getting darker but the sunset is still bright.

Meteorites of 1421

Niconovsky (6829): A very terrible sign. During the spring, on May 19, on Sunday, the day of All Saints, about midnight, there was a great vibration of the air in the city of Novgorod. A large dark cloud appeared from the south, with thunder and lightning; people could not see anything, and everybody expected to be burned. The cloud came nearer and stood still above the city and then changed from rainy to fiery appearance. The people, expecting a fiery death for theirs sins, began to call in terror, "Lord, have mercy on us", while many others were praying to the Lord, His Holy Mother, and to all the Saints. And then there was heavy rain and hail and stones fell from the sky on the earth. When the day came and the light was shining again everything became quiet; the fiery cloud disappeared and the people gradually recovered from fear.

Sunday of all Saints in 1421 fell not on the nineteenth but on the eighteenth of May.

Aurora of 1431

Niconovsky (6939): During the same year there was a sign. Three fiery pillars appeared in the sky.

Similar records are found in the Voskresensky and Simeonovsky chronicles.

Fireball of 1476

Pskovsky (6984): During the same night (on Thursday, the 21st of November) many true-believers saw a fiery pillar which stood above the city of Novgorod and reached from the sky to the earth. They also heard thunder in the sky, but it all disappeared toward daylight.

This phenomenon must have taken place on November 22, because the 21st fell on Wednesday. The description probably refers to a fireball and not an aurora.

Meteor shower of 1479

Voskresensky (6988): About the falling of the stars. During the same month of September, on the 21st, in the fifth hour of the night, in the village of Olexinskoie, across the river Oka, many persons saw that the stars fell on the earth like rain from the sky, and striking the earth they scattered like sparks and became invisible.

In the Niconovsky a similar record is given under March 30. Both chronicles describe first the great fire of Moscow, then the falling of the stars, and finally, spontaneous ringing of the church bells. In the Voskresensky the great fire is placed under September ninth at the sixth hour of the night from Thursday to Friday, then the falling of the stars is recorded on the 21st of September, the first ringing of the bells is on the thirtieth of the same month, and the second on the eleventh of

November, from Thursday to Friday, in the night. In the Niconovsky chronicle the fire of Moscow is recorded on March 29, in the sixth hour of the night from Thursday to Friday, then the falling of the stars on the thirtieth of the same month, the ringing of the bells on the 31st, on Saturday, and the second ringing on April 11, from Thursday to Friday. It is seen, then, that the days of the week in both records are identical and only the dates and names of the months are changed. It looks as if one of the chroniclers tried to substitute the "Spring Year" for the "September Year" or vice versa, and did it rather clumsily.

Aurora of 1490

Novgorodsky IV (6999): During the same autumn, on the eighth of November, from Monday to Tuesday, about the fourth hour of the night, there appeared a sign. From the summer east to the summer west on the north side the sky became bright as the glow of a sunset on a clear day and in this glow there were pillars like the sun's rays, but large and bright. And these rays illuminated the whole city and the suburban fields as would a large conflagration. And the pillars came close together and then separated again, and this closing and separating occurred during the night many times. It all lasted for three hours or more and then was gone. And again three pillars appeared, very large and very tall, and remained there for a long time. And when the time arrived to begin the early morning service, some clouds appeared from the east and darkened this brightness. And then one hour later the morning dawn appeared in its usual way and God gave us light again. And in the Yuriev monastery they saw this terrible fire and they thought the whole city was burning.

The same record is found in the Niconovsky chronicle.

Fireball of 1491

Niconovsky (6999): The apparition in the air of the Saint Grand Prince Alexander Nevsky. In the year 6999 in the great city of Vladimir there was an awe-inspiring apparition and frightful and terrible sign of the wrath of the Lord. Thus the Lord punishes us and leads us from sin toward repentance. On a certain day after the morning Mass many saw the following appearance above the stone church of Our Lady and the residence of the abbot. Just above the place where the remnants of the Saint Prince Alexander repose, on the very dome of that church, they saw a strange sign. It was as if a light cloud or thin smoke spread around, white as a pure frost and bright as the sun. Then the people saw the likeness of the Holy Prince on a white horse rising up toward the sky. The people who saw it were very frightened and began to toll the bells all over the city.

It is possible that the luminous cloud was a train of a fireball which suddenly passed above the church and could be seen even in daylight, as sometimes happens.

Leonids of October 24, 1533

Niconovsky (7042): About the stars. There was a sign in the stars, and the Grand Prince Vasily was very ill while he was near Volozh. Before his death many stars fell down on the earth from the sky. (And in another copy of the same chronicle.) About the stars. During the same autumn, on October the 24th, during the night from Friday to Saturday, in the city of Moscow many people saw that the stars in the sky elongated themselves like ropes and flew from the east toward the winter west.

According to the "September Year", the fall of 1533 was already counted as the beginning of the year 7042. H. A. Newton showed that the Leonids of 1533 were observed on the 24th of October. The chronicler even indicated the approximate position of the radiant.

Aurora of 1548

Niconovsky (7056): During the same winter, on January the thirteenth, from Friday to Saturday, in the third hour of the night, many rays appeared in the sky. They were on the northern side and were fiery and were visible all through the night till the morning dawn. During the same winter on February the ninth, from Thursday to Friday, in the night, many rays appeared on the northern side of the sky, but they disappeared before the morning service.

Aurora of 1549

Niconovsky (7057): During the same winter, on February 25, during butter-week, on the night from Monday to Tuesday, a light appeared on the northern side of the sky which looked like the dawn before the sunrise; and it remained there until the daybreak.

Aurora of 1551

Novgorodsky II (7060): In the month of September, on the 23rd, on Wednesday, during the time of the early morning service, a sign appeared in the sky. Pillars were rising from the eastern side like the sun's rays and then a flame appeared in the sky shimmering and moving hither and thither like water in the sea for several hours. A bright light was coming from these flames and rays, but in the west was great darkness. Then the merciful Lord gave us light; the sun rose on the first hour and then it became dark again for many hours. It all happened under the Archbishop of Novgorod, Serapion Kurtzev.

The year 7060 began in September, and the 23rd of September fell on Wednesday in 1551. There was no solar eclipse on that day, and the darkness described here was probably caused by dense clouds which covered the sky after a bright morning.

Aurora of 1554

Novgorodsky II (7060): In the third year after 7060, on the tenth of October, in the night from Wednesday to Thursday, from the first to the fifth hour of the night, there was a sign in the sky. Flames moved like lightning and set the sky on fire; big strips of white, red and blue moved everywhere, and it was impossible to understand it. And the flames moved apart and then clashed against each other as if they were crowds of people. The flames separated and collided like this three times and some other flame like lightning darted through the fire. It happened on the day of the Apostle Philip, on October the eleventh.

Fireball of July 31, 1556

Pskovsky I (7064): During the same year, on the eve of the Lent of Assumption, there was a sign. At the same place where the star was in the sky there appeared the likeness of a headless serpent, which stood in the sky not far from the earth, and then people saw it lifting its tail like a trunk, and become like a barrel; then fire fell to the ground and spread there like smoke and threw up some dirt; and it remained there for about an hour.

The Lent of Assumption always begins on the 31st of July. [By "the star" the chronicler means here the comet of 1556.]

Aurora of 1560

Novgorodsky II (7069): In the same month of December, on the 29th, on Sunday there was a sign in the sky. Red and blue pillars moved forth and back, and rippled the sky like water for a long time.

Fireball of April 17, 1564

Novgorodsky III (7072): In the year 7072, on the seventeenth of April, a fire went up from the church of the Holy Ghost and then the same fire fell down in the yard of Viazhitsky in Jacob Street, and many people saw this miracle and were terrified.

Aurora of 1571

Novgorodsky II (7080): In the month of September, on the thirtieth day, on Sunday, when the early morning service was in progress, there was a sign in the sky. There were rays all over the sky, and they moved as the water is moved in the sea by the wind. Those rays spread over the sky; they had a variety of colors and continued until dawn. Then our merciful Lord gave us light again.

Aurora of 1572

Novgorodsky II (7080): Also in the month of February, on the ninth, on Saturday of butter-week, during the night, there was a sign in the sky. Great colored lights moved all over the sky.

V. Sunspots and daylight visibility of planets

Sunspots in 1365 and 1371

Niconovsky (6873): During this year there was a sign in the sky. The sun was like blood and there were dark spots on it, and haziness lasted for half of the year. The heat was very intense; the forests, the marshes and the earth itself burned, the rivers dried up, some water-covered lowlands dried up completely, and there was terror, dread and sorrow among men.

Niconovsky (6879): During this year there was a sign in the sun. There were dark spots on the sun, as if nails were driven into it, and the murkiness was so great that it was impossible to see anything for more than seven feet, and many people walking collided, bumping face to face, and the birds flying through the air could not see and fell to the ground. Also, the wild beasts not able to see came in the villages and towns and mingled among men; bears, wolves, foxes, and other wild creatures. The drought was great and the heat also, so that men were terrified and trembled. Many rivers dried up and also many lakes and marshes. Woods and forests were burning and the dry marshes began to burn, and the earth itself burned, and great fright and terror spread among men.

Similar records are also found in the Lavrentievsky, Voskresensky and Simeonovsky chronicles. The sunspots in the shape of the heads of old-fashioned handmade nails could be noticed because the smoke from forest fires made it possible to look at the sun directly. The size of the spots must have been unusually large. The records of other drought years, such as that of 6882, do not mention the sunspots. The year 1371 was probably not far from the time of the sunspot maximum, since a strong aurora was recorded in the same chronicle in 1370, and the Chinese noticed sunspots in the years 1370—1375.*

Daytime visibility of Venus in 1331

Novgorodsky I (6839): During the same year Reverend Vasily went to Volynia ... and on the day of Saint Titus he was consecrated Archbishop. Then a sign was seen in the sky; a bright star stood right above the church.

Novgorodsky II (6839): Then there was a sign in the sky; a bright star stood above the church all day.

Pskovsky I (6839): At the same time a bright star appeared and stood above the church all day.

A similar record is found in the Voskresensky, where the date of the Archbishop's consecration is definitely given as August 25. In 1331 neither a bright comet nor a nova or supernova was observed anywhere. According to Viliev, Venus on August 25, 1331 was almost in its greatest western elongation (42°20′), and although its brightness was only 0.74 of its greatest value, it was high above the horizon during the morning hours and consequently easily noticeable.

* Hirayama, Observatory, *12*, 218.

Concluding Remarks

This historical material has been made accessible to scholars by the tremendous undertaking of the old Russian Archeographic Commission initiated more than a century ago. As early as 1722 Peter the Great had instructed the newly founded Academy of Sciences to take measures for collecting and publishing ancient texts. As a consequence, by the end of the 18th century some seven chronicles had been published, but the progress was slow. In 1837 a selfperpetuating organization was created, the Archeographic Commission. It was this group of scholars which collected, edited and published twenty-four volumes of the Medieval Russian Chronicles. The present author does not know what organization, if any, is continuing this work. Undoubtedly there remains much to be done; as late as 1922 Likhachev found a new chronicle, the so-called Rogozhsky, and this, according to Priselkov (l. c.), has now been published. Priselkov also states that some important texts, such as Rostovsky and Dubrovsky, remain unpublished and that a new edition of Volume V of the Collection (undertaken in 1925) remains unfinished.

Much of the charm of the original illuminated manuscripts is unavoidably lost in the translated extracts presented here. The introductory plates of the first four or five volumes of the Collection reproduce beautiful examples of lettering, illumination and illustrations; these cannot fail to arouse the admiration of any lover of the history of art.

Up to the time of Sviatsky's compilation of the astronomical records, 23 volumes had been published. These include all but the last of the volumes in the appended bibliography. The present author is not informed as to whether Sviatsky has continued his research in this field. However, his article in Popular Astronomy in 1930 leads us to hope that his work has not been closed. In any event, astronomy is greatly in his debt for the magnitude of this contribution to the history of science and for the high scholarship which he has brought to the task.

The list of the volumes of the Complete Collection of the Russian Chronicles in the Library of Congress, Washington D. C. follows; all were published in St. Petersburg (now Leningrad).

Volume	Edition	Chronicle	No. of pages	Years covered (A. D.)
I	1846	Lavrentievsky	209	913—1305
		Troitzky (fragment)	25	1206—1419
II	1843	Hypatievsky	227	1111—1305
		Gustinsky	182	912—1596
III	1841	Novgorodsky I	114	1016—1446
		Novgorodsky II	53	911—1583
		Novgorodsky II, App.	13	1510—1565
		Novgorodsky III	72	988—1716

Volume	Edition	Chronicle	No. of pages	Years covered (A. D.)
IV	1848	Novgorodsky IV	130	1113—1477
		Academichesky	7	1447—1515
		Chronograph	27	1385—1496
		Pskovsky I	168	859—1650
		Pskovsky I, App.	4	1547—1609
V	1851	Pskovsky II	46	854—1486
		Sophiisky I	194	852—1462
VI	1853	Sophiisky I	54	1469—1509
		Sophiisky II	178	1392—1534
		Voskresensky	49	1445—1553
VII	1856	Voskresensky	217	975—1353
		Voskresensky	86	852—1074
VIII	1859	Voskresensky	293	1354—1541
IX	1862	Niconovsky	254	859—1176
X	1885	Niconovsky	234	1177—1362
XI	1897	Niconovsky	239	1362—1424
XII	1901	Niconovsky	259	1425—1506
XIII, p. 1	1904	Niconovsky	302	1506—1639
XIII, p. 2	1906	Niconovsky, App.	408	1558—1567
		Royal Book	123	1534—1553
XV	1863	Tverskoy	502	852—1499
XVI	1889	Avrahamka	222	859—1469
		Avrahamka	16	945— 988
XVII	1907	Supralsky	69	1097—1446
		Lituanian	15	1295—1392
		Moscow Grand Prince	14	970—1237
		Academichesky	18	1338—1446
XVIII	1913	Troitzky (fragment)	21	1367—1414
		Simeonovsky	258	1177—1494
		Troitzky (fragment)	4	1392—1408
XX, p. 1	1910	Lvovsky	380	858—1533
XX, p. 2	1914	Lvovsky	203	1534—1560
XXII, p. 1	1911	Russian Chronograph	427	980—1533
XXII, p. 2	1914	Russian Chronograph (West-Russian variant	266	816—1527

Volume	Edition	Chronicle	No. of pages	Years covered (A. D.)
XXIII	1910	Yermolinsky	162	852—1488
		Yermolinsky, App. 1	12	1477—1491
		Yermolinsky, App. 2	15	1427—1533
XXIV	1921	Typographsky	224	852—1534
		Typographsky, App.	10	1485—1496

Notes. 1. Volumes XIV, XIX, and XXI are not listed here because they contain historical material not in the form of chronicles; i. e. Genealogies of Princes, Lists of Bishops, etc. 2. Apparent inconsistencies in the years covered by various chronicles appear because the Commission frequently used portions of different copies of the same chronicle. 3. The events recorded prior to the year 980 are largely copies from Byzantine chronicles. 4. The Troitzky Chronicle was lost in the Moscow fire of 1812 and only fragments of it were preserved by the historian Karamzin. However, Priselkov has recently demonstrated that Simeonovsky (Vol. XVIII) is a very close copy of it.

Map of Russia around 1250 A. D.

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