Information in the document of the 1730s about iron ores that were mined near the city of Tula

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Abstract. The paper presents data on the ore and the location known to the ore-finders working in the vicinity of Tula in the 1st half of the 18th century. The archival document of the year 1733 (the list compiled by Demidov), the list of types of iron ores of the area, was found and used as a material for the investigation. We specify that the majority of titles of iron ores were associated with the sites of ore occurrence. The inference can be made that the geological surveying and mining were carried out intensively. The paper presents an investigation of the question whether miners and iron makers had linked together the qualities of the discovered ore and the quality of iron or not. The classification of the list (of types of iron ore of the area) was compared to the classifications of Russian and Norwegian authors of the 18th century. We cite data from other records. We underline that the work of ore-finders was successful, average lifetime of some mines was about 100 years. The results of the study can be used in interpretation of the results of archeological studies.

1. Introduction
Iron making is one of the oldest crafts of the rural population of Tula region. First records about it went back only to 1580s. There is no doubt, however, that by this time iron making had already had a definite history in the region. Ore was mined by mine-workers. Their activities were as ancient as the activities of iron-makers. Sustained supply of ore was not possible without studies of the natural resources of the region. This paper presents an investigation of the search and the study of ore occurrence in the region.

Historical sources of the 18th century on the search of ore deposits in Russia are few and are of poor contents. There is only a detailed description of the practice of iron ores search of the middle of the 18th century in the manual of I.A. Shlatter, the Head of the Mining board (Berg-kollegia), Obstoiatelnoe nastavlenie rudnomu delu (Full manual on ore mining) [1]. In the manual Shlatter described places of ore occurrence, ore layers and seams, ore search method (chapter “On signs of ore seam presence and the search of seams”), operating of new mines, mines machinery, preparation for the processing of ores, ores picking, breaking, washing. The manual had engravings that could have been used as a referral source on the subject. Shlatter described in detail the technical aspects of the mining but he had shown no interest in the history of the search and the find of iron ores. The same method holds true for the scientific papers of M.V. Lomonosov “Pervye osnovaniia metallurgii ili gornyh del” (The fundamentals of metallurgy or mining engineering).

Scientists of the 19th and 20th centuries gave attention to the history of mineral exploration and minerals studies in definite geographical regions of Russia. A.A. Ievlev examined history of finding of
ores on the river Tsilma that started at the end of the 15th century. He thought it possible to describe some types of relief as traces of old mining works [2]. E.A. Kuraliev and I.L. Mankova studied the subject of the search and the development of iron ores deposits in Ural and Siberia region. They found how the discovery of mines correlated to the direction of colonization flows, what was the process of mineral exploration during the expansion of new lands, what triggered the exploration of ores, what share had private and state initiative in the process of search of mineral deposit, what was the process of mineral exploration on the new lands [3].

The European part of Russia or the vicinities of Tula were not examined in the larger half of studies of the history of mineral exploration. The nearest place to Tula mentioned in these studies was a place near Dedilov town on the river Olen. There were mines referred to in the records of the 17th century. But these records reported only of the small territory and of the ore production. For this reason the history of the mineral exploration in this region and the increase of knowledge of the natural resources of the region were not covered in the literature. The survey of K.N. Serbina on the peasant metallurgic industry can be taken as an exception. The author touched the subject of the provision of ore. K.N. Serbina did the survey of large territory of three neighboring counties, Aleksinskii uezd, Dedilovskii uezd, Tulskii uezd, one chapter for each county. These chapters contain references to the places of ore production [4]. However, the survey of K.N. Serbina did not examine the history of mineral exploration and the increasing knowledge of the natural resources of the region.

One branch of this human knowledge was the knowledge of the types of ores and of the link between the type of iron ore and the quality of iron. In Russia this experiential expert knowledge was summarized in a multivolume study of I. Shlatter “Obstoiatelnoe opisanie rudnago plavilnago dela” (Full description of ore smelting…) (1763-1784). Shlatter described the identification of the type of ore by its appearance in Chapter 1, Volume II of the book. The author gave us the description of obyknennoi kamennoi zheleznoi rudy (iron ore), reported distinguishing features of the valuable ore according the nature of fracture. He described other rocks and ores suitable for the production of iron: ore of oshpatovatogo vida, krovavik (similar to glaskopf), nazhdak, braunstein, etzenman (the same as eizenglimer), volfram, three types of kolchedan – sernyi, zheltiy, belyi, zheleznaia vohra, chernyi pesok, magnit [5]. It is possible that the description was based partly on the experience of ore-finders in Russia, but the classification as we see from the names of types of ore represented knowledge of German geoscientists and specialists in mineralogy.

We cannot exclude the possibility that expert knowledge of Russian ore-finders, rudoznattsy (experts in ores and the search of them) was recorded. But we have not found the historical records of the 17th and 18th centuries on the subject or the mentioning of them. We can expect the find of such historical records for Tula region and the adjacent areas.

The main part of Tula region is Tula ore region with its characteristic outcrops of iron ores (mainly brown iron ores). The existence of domnitsa (hearts where the direct reduction of iron from ore take place) is mentioned in the records of 16th, 17th and 18th centuries in Tulskii, Dedilovskii, Krapivenskii, Aleksinskii uezd (Tula, Dedilov, Krapivna, Aleksin counties). Three of them were within the boundaries of the main ore field of Tula iron-ore area. As we can see the location of rural iron making centers are in line with the place of ore occurrence. Minor enterprises of local peasants were main consumers of local ores. Extraction of ore was made mainly by peasants. They had no resources to seek for advice in ore finding from outside specialists. But they had no need to do this because the outcropping of ore was a common place there. Peasant miners were satisfied by the results of their own search work. Surely locals had material knowledge representing their skills and experience in ore finding.

We assign the objective to find out what kind of data on Tula ores and the locations of the ore were known to iron-ore finders of the region in the 1st half of the 18th century.

2. Methods and materials
Relation of the location of centers of rural iron making to the location of ore mining is an established fact. We hope we can extract information about places of ore-mining from the sources of history of local
metallurgy. This could add to the history of the research and the development of natural resources of the region.

We studied documents of two Archives. We looked for the documents of 1720 and of later time in Gosudarstvennyi arhiv Tulskoi oblasti, Fond 55 (Tulskaiia provintsialnaia kantseliariia) (State archive of Tula region, Collection of papers 55, Tula Province Chancellery). We studied documents of Russian State Archive of Ancient Acts (RGADA). Records of the Fond 271 (Berg-kollegiaiia) (Collection of papers 271 (Mining board), RGADA) are of great interest. We have found data on the locations of ore mining in the records of the beginning of the 1730s regarding the collection of tax for iron makers. Data was compared to data on iron ores of the studies of norwegian and russian scientists of the 18th century. Data on the mining locations was compared to cartographyc documents.

3. Results and discussion
The study revealed a document containing the list of ores mined around Tula in the 1730s. Here are the circumstances of its compilation.

In the late 1720s a controversy occurred between the gunsmiths of Tula and Nikita Nikitich Demidov. Demidov was a furnaces tax money official at a time. The conflict escalated into personal controversy between Nikita Demidov and Makar Polovinkin, head of the Tulskaiia oruzheinaia kontora (Tula armory office). Polovinkin proposed to close all ironworks in Tula region since they lessened the supply of timber and ore in the region, which could make difficult the manufacturing of weapons in the future. Demidov had not agreed with it. In his letter to Kommerz-kollegiaiia (Commerce-board) of July 14, 1733, he stated that Tula iron should not be used for the making of arms. Siberian iron was best suited for this. Coal and ore of better quality were used in the production of Siberian iron.

Demidov reported details on Tula ores. He wrote there was a lot of ore in the region of Tula. The location of the ore was in the lands of landlords and in zaseka (Zaseka are old thick woods, felled-tree barriers used to protect Tula from the raids of southern neighbors). Demidov cited the names of the types of iron ore mined in the vicinity of Tula. The List included the following zvaniia (titles) of iron ores: 1 medved, 2 ovshianik, 3 smolian, 4 strekalov, 5 ivashkin, 6 sherap, 7 kostomar, 8 aleshenskoi, 9 kostomar akuninskoi, 9 retin, 10 pirogov, 11 leskoi, 12 frolovka, 13 degatna, 14 baturka, 15 liubogoshch, 16 oslon, 17 kochan, 18 baturinskoi, 19 alen, 20 nikolskoi, 21 salomas, 22 kolpna, 23 shchekin. Demidov noted that iron made from twenty of the cited ores was not good for the manufacture of weapons. The ore of Tula region, which was good enough for use in weapons, was of lower quality than the ore of Ural region [6].

Data on the region reported in this document is unique for today. Analysis of the text allows us to make several conclusions.

First of all we deal with the unique written records of empirical data of local ore-finders and iron-makers of the region of Tula. List of Demidov was in fact a primitive classification of ores found and mined in the region. Later, specialists in the field of metallurgy and mineralogy developed much more advanced classifications. Such was the classification of Norwegian scientist O. Ewenstad based on the study of local ores that was published half a century later [7]. Information about the kinds of iron ores was given in surveys of M. Lomonosov and I. Shlatter. The information on the ores of Russia had to be summarized in Rossitskaiia mineralogiaiia (Russian mineralogy), an unfinished project of M. Lomonosov. Samples of minerals and rocks were sent to M. Lomonosov from every place where the iron-making factories were existed [8]. The list of ores reported by Demidov was simple, but it dated from the earlier time and described the ores of the Tula region that was not present in the surveys of Lomonosov and Shlatter.

In the second place, iron ore seams and lenses of ore in the vicinity of Tula had unstable chemical compositions. Ore characteristics in the volume of ore body were inconstant. All these characteristics determined the quality of iron. Did the iron-finders link chemical compositions of ore with the qualities of iron made of it?

We reply in the positive to the question. Demidov reported that ores were different in quality, some of them could be used in the production of weapons. This can be considered as the first proof. If ores
differed from each other only in the place of location, it would be logical to give the list of mining locations not the list of the names of ores. This can be considered as the second proof.

In the third place, ore-finders participated in search of the ore occurrence but also in mining. Mining was done in some of the locations found by ore-finders. If we assume that one kind of ore was mined in one exact mine, we could say that at least 23 of mines operated simultaneously. This indicated intensive mining in the vicinity of Tula in the 1730s. It was possible because of the presence of ores in Tula region and the exploration of ores.

This conclusion agrees with the known active mineral exploration of the region which was not limited to the exploration of iron ores [9].

In the fourth place, ores were mined, according to Demidov, in landlords land and in zaseka. Names of zaseka, for example, Malinovaia, are often found in the records of the 1700 - 1730s on the ore mining. As an example we could bring the records on appropriation of land in Malinovaia zaseka for mining in 1727. Owners of the metallurgical furnaces of armory district of Tula presented a petition. They reported they made iron and steel from the ores they bought from peasants who mined ores in Malinovaia zaseka. According the report of the owners of furnaces, recently the mining of these ores were forbidden for everyone except the family of Demidov. Metallurgists pleaded to permit peasants to mine the ores and to supply ores to Tula for “use in weapons”. They were afraid, the quantities of ores were not sufficient to cover the needs of the armourers of Tula and proposed to forbid mining for those, who sold ore to another places. [10].

The list of Demidov contained information about the location of sites of iron ore mining. The names of ores were given often according the places where they were collected, namely linking the name of ore mine to the name of human settlements. Names of the kinds of ores, such as medved, ovsianik, strekalov, pirogov, salomas, shechen and others, matched the names of settlements that were situated nearby zaseka. We could compare them to names of settlements fixed in Ekonomicheskie primechania k Generalnomu mezhevaniiu (Economic annotations to General land survey). It could help to localize mines and places of ore processing, such as places of roasting and the reduction of ores.

The same names of settlements we could see in the records concerning conflicts of the ore-mine workers. We could give an event of 1730 as an example to illustrate the point. Servants of Akinfii Demidov caught peasants of the village Ovsiannikova of landlord S. Izvolskii for the reason that they mined ores on the land granted to Demidov in Malinovaia zaseka.

4. Conclusion

There is a growing interest in archeological studies of the lands of zaseka and zasechnaia cherta (felled-tree barriers and fortifications of the 16th-17th centuries) in the recent years. Not only remnants of fortifications but the artifacts of different provenance and age were found on the lands of zaseka and the adjacent areas. Some of them are the archaeological evidence on the iron ore mining (also known by written evidence) and rural iron production in the area (in particular in Malinovaia zaseka). We cannot implement the task of finding the sites of mining and processing of iron ores entirely with the help of written documents. The list of Demidov provides us with the reliable data on the places of ore mining in the 1730s.

Information of the written evidence like the list of Demidov could be used in the interpretation of archaeological finds. Blast-furnace factories of Tula region together with the furnaces of rural iron-makers consumed less ore than it was able to mine in the region. Demand satisfied supply. Some ore mines remained working mines for a long time. The mine near the village Solomasova, mentioned as salomas ore in the list of Demidov, was producing mine up to the middle of the 1820s [4]. This settlement existed on the plans of General land survey and other cartographical documents of the end of the 18th century and the 19th century. The long term of functioning makes it difficult to date archaeological finds of the mine. But the time data binding (dates were given by the list) seems to be useful since it gives us the reliable chronological data on the mines.
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