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**The Urals and Yekaterinburg through the eyes of a foreigner in the middle of the 19th century**

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The famous English geologist R.I. Murchison headed international geological expeditions to Russia in 1840 and 1841, created the first geological map and gave a description of the geological structure of European Russia and the Urals. On the expedition of R.I. Murchison, the Permian system was distinguished. His brief descriptions of geological objects, the way of life of the population and industry of the region, the relationship between different strata of citizens in imperial Russia are interesting.

Key words: Permian system, personalia, R.I. Murchison.

To get acquainted with a short biography of R. Murchison, a remarkable man from a distant time, his multifaceted activities, we will be helped by a fairly complete biographical sketch of N.S. Shatsky (1986) [2] about his life, as well as an entertaining book by the Permian geophysicist S.Ye. Waxman (2007) [1].

Roderick Impey Murchison (Fig. 1) was born on February 19, 1792 in Rossshire, in northwestern Scotland. In 1799, Roderick was sent to primary school in County Durham, and at the age of 13 in 1805 he was admitted to the Royal War College in the vicinity of London. In 1807 he was assigned to the 36th Infantry Regiment without occupying a specific position. The following year, a regiment in the corps commanded by General Wellesley (the future Duke of Wellington) supported the Portuguese uprising against Napoleon. After several successful battles in clashes with the French, the regiment suffered a serious defeat and was taken to England. Murchison's six-month fighting career ended.

This was followed by a long garrison service in the same regiment in England, Italy, on the island of Sicily. In 1815 he joined the cavalry with the desire to make a career in the military. But the war on the continent with the Napoleonic army was over, and there was no hope of a quick promotion.

In the same year 1815 R. Murchison married and retired. Under the influence of his wife, Murchison turned from a fox hunter into an amateur naturalist and then into a professional geologist.

His geological career was divided by N.S. Shatsky into three periods.

*The first period - 1824-1830.* - teaching geology and preparing for future research. During these years, most of the works were written by him together with Sedgwick and C. Lyell. Young Charles Darwin took part in some geological excursions as Sedgwick's assistant.

*The second period lasted from 1831 to 1845.* At this time, the main geological studies of Murchison were carried out: he, together with Sedgwick, substantiated two geological systems in English - the Silurian and the Devonian, and identified the Permian system in Russia. Capital monographs were devoted to each system in England. At the end of this period, work was completed on the geology of European Russia and the Ural Range.

*The third period, covering 1846-1871*, was the time of his intense scientific-organizational activity. In 1855 R. Murchison took over as director of the British Geological Survey and director of the London Museum of Practical Geology. He actively worked on the Council of the Geological Society of London from 1826 to 1868. From 1844, almost until his death, R. Murchison was the permanent chairman of the Royal Geographical Society.

The scientific merit of the geologist was marked with many distinctions and honours. He was elected a full member of the St. Petersburg Academy of Sciences, an honorary doctor of many European and American universities. In 1846 he was knighted, and in 1866 he became a baronet. The famous scientist-geologist died in 1871.

R. Murchison by his convictions remained a conservative. Until the end of his life, he did not accept the teachings of C. Lyell, nor did he understand the events of large areal glaciations on Earth in the geological past, despite the fact that he was well acquainted with the glaciers of the Alps. He belonged to those Englishmen who were outraged by Charles Darwin's conclusions about the relationship between ape and man.

**Traveling to Russia**

**R. Murchison's first trip to Russia (1840)**

What attracted R. Murchison in Russia? First of all, the problems of the stratigraphy of England. The Silurian and Devonian deposits developed on the island are strongly dislocated by the Caledonian orogeny, and the relationship between individual parts of the section was highly controversial. On the territory of northwestern Russia, rocks of the same age lie almost horizontally, and the position of different strata was not in doubt. Checking the correctness of the interpretation of the sedimentary formations of Great Britain on the example of the vast expanses of the Russian Empire was the first task of the journey.

The opportunity to travel to Russia opened up when R. Murchison met A. Meyendorff, a Moscow expert in economics and the first organizer of the society for the study of Russia's natural resources. The meeting took place in Paris, where Murchison was introduced to Meyendorff by the French paleontologist E. De Verneuil. At this meeting, it was agreed that in June - August 1840 Verneuil and Murchison would travel across Russia together with Meyendorff. At the beginning of the excursion in June this year, before the departure of the expeditionary group from St. Petersburg, Murchison was also introduced to the Minister of Finance of Russia, Count Kankrin, who acted as the guarantor of the expedition.

The first studies were carried out in the vicinity of St. Petersburg, along the banks of the Volkhov and Syaz rivers, as well as along the western shore of Lake Onega. Then the expedition split up, and the mineralogist N.I. Koksharov joined the group of Murchison and Verneuil. This group travelled from Vytegra to Arkhangelsk, where its members examined the shores of the White Sea and the river Pinegi. Then along the banks of the Northern Dvina river, the travellers reached Veliky Ustyug, and further along the river Sukhona to Vologda. From Vologda, through the city of Cherepovets, they drove to Yaroslavl and Kostroma, where they re-united with Meyendorff's group. Then the section of the banks of the river Volga was studied to Yuryevets. After that, the expedition returned to Moscow, where Murchison and Verneuil became acquainted with the geology of the city's environs and made excursions to Nizhny Novgorod, Murom, Kasimov, Ryazan, etc.

In the northwestern part of Russia, these geologists were able to recognize, in addition to ancient crystalline rocks, the Old Red Sandstone formation above the underlying Silurian. Upon his return to England, R. Murchison, on behalf of himself and E. Verneuil, presented to the British Association for the Advancement of Science a report on the results of field work in Russia, the meaning of which was reduced to the correlation of the Silurian-Devonian deposits of Great Britain and Russia and to the confirmation of the Devonian age of the ancient red sandstone on the palaeontological material of Russia.

**R. Murchison's second trip to Russia in 1841**

The processing of field data in the winter of 1840 further sharpened Murchison's interest in the geology of Russia. In addition, he received a very flattering invitation from the government of the Russian Empire to continue work on the study of the country's geology.

In April 1841 the expedition left for Russia. In addition to Murchison, the expedition included E. Verneuil, as well as two Russian geologists - A.A. Keyserling and N.I. Koksharov. After moving from St. Petersburg to Moscow, the geologists examined the structure of the Moscow Region coal basin. Then the expedition was divided into two groups.

One detachment moved to Kazan through Arzamas, Penza and Simbirsk. The second detachment - Murchison - walked along the Volga through Vladimir and Nizhny Novgorod. Further joint study of the geological structure of the Russian Plain took place along the Kama and Vyatka rivers to Molmyzh, then along the highway to Okhansk. Having studied the Paleozoic deposits in the area of ~~​​~~Perm, Solikamsk and further along the river Sylva near Kungur, the expedition moved to Yekaterinburg along the old Moscow tract with a side route to Nizhnie Sergi (Fig. 2).

We learn about the routes of the expedition in the Urals from Murchison's field notes, which are cited below. After returning from the northern routes (Fig. 3) to Yekaterinburg, the expedition went down the river Iset to the village Kolchedan, near which the dislocated Paleozoic formations of the Urals are overlapped by horizontally lying Mesozoic sediments of Western Siberia.

After this route, the expedition was again divided into two groups. Keyserling’s detachment crossed the Urals and descended from the Nizhnye Sergi along the river Ufa, defining the boundary between Paleozoic rocks and Artinskian sandstones. Murchison and Verneuil continued to study the geology of the eastern slope of the Urals. Then the detachments united in the city of Zlatoust.

After a series of joint excursions in the vicinity of this city, the detachment again divided. Verneuil and Keyserling went through the Satkinsky and Simsky factories to Ufa and then to Orenburg. The group of Murchison and Koksharov proceeded through the Miass and the Ilmen mountains, then moved to the Troitsk region, and from there to the river Ural. Moving along the valley of this river, the travellers reached Orenburg.

After joint trips in its vicinity, Keyserling's group moved down the river Ural to the Kirghiz steppes. Murchison and Verneil moved along the highway from Orenburg to the city of Verhneuralsk, from which they crossed the Ural ridge in the direction of Sterlitamak. This completed the study of the geology of the Ural Ridge.

Further, the expedition visited a number of points in the south of Russia, with special attention paid to studying the structure of the Donetsk ridge and the structure of the Voronezh shield - outcrops of ancient crystalline rocks of the basement of the Russian platform. Through Kharkov, Belgorod, Kursk, Oryol and Moscow members of the expedition returned to the Russian capital. In the late autumn of 1841, Murchison returned to England.

His expedition mastered a route more than 20,000 km long, visiting different areas of the vast East European platform, several crossings of the Urals, acquaintance with the territory of the Caspian depression, studied the Donetsk aulacogen and the Ukrainian shield.

The period between 1841 and 1845 was filled with the processing of materials from the two expeditions, numerous reports and publications. In 1845, a two-volume work "The Geology of Russia in Europe and the Ural Mountains" was published. The first volume was written mainly by Murchison. A. Keyserling added to it a description of the geological structure of Timan, the adjacent regions of the Pechora basin, the Polar Urals. This volume was written in English.

The second volume dealt mainly with the palaeontology of Russia. The Paleozoic fauna was described by E. Verneuil, A. d'Orbigny gave a description of the Mesozoic and Cenozoic fossils. The second volume was in French.

For more than 40 years, Russian geologists perceived the country's geology from the standpoint of R. Murchison, which can be shown using the example of the Permian system. In the understanding of the English geologist, only the upper part of the modern Kungurian stage, the Ufimian, Kazanian and Tatarian stages of the Upper Permian were attributed to the Permian system. All the diverse deposits of the modern lower section were considered as part of the Carboniferous system by Murchison.

From the standpoint of the modern stratigraphy of the Urals and European Russia, Murchison made many mistakes in determining the age of the rocks. So, he considered the Permian red beds of the northwest of Russia to be Carboniferous deposits. When driving along the Moscow highway from Kungur to Yekaterinburg, terrigenous (clastic) rocks in the Bisert River basin were also compared by Murchison to the Carboniferous strata of England. But these inaccuracies against the background of the complete stratigraphic uncertainty of the region are quite understandable.

Subsequently, R. Murchison put a lot of effort into introducing the concept of the "Permian system" into geological use. At that time, sediments of Central and Western Europe, approximately the same age as the Russian Permian, were defined by the concept of the "Dyas", that is, two-term, since they included two strata - the lower one called “Rotliegendes” and the upper one called “Zechstein”, consisting of gypsum-anhydrite, salt and carbonate deposits, outwardly similar to our Kungurian. The lower stratum was named "dead bed" due to the absence of marine fossil organisms.

Subsequently, the establishment of the modern extent of the Permian system in Russia was a complex and lengthy process. A.P. Karpinsky (1874), when studying the boundary Carboniferous-Permian deposits of the Western Urals, considered the lower section as a transitional unit from the Carboniferous to the Permian - "Permocarbon", to which he gave the second name - the Artinskian stage. The first researcher who decided to attribute the "Permocarbon" to the Permian was A.A. Krasnopolsky (1889) - senior geologist of the Geological Committee of Russia at the completion of geological survey on the western slope of the Middle Urals.

From the Artinskian stage A.P. Karpinsky then identified the components of the lower section of the Permian system, the Asselian, Sakmarian, Artinskian (in reduced volume) and Kungurian stages of the modern scale.

R. Murchison's contribution to the formation and development of Russian geology has always been positively assessed by the country's geologists. In the war of 1941, the centenary of his travels across Russia was celebrated by the staff of the Mining Institute in Sverdlovsk. In honour of the 150th anniversary of this event, the Ural Branch of the USSR Academy of Sciences, together with the Institute of Geology and Geochemistry, the Mining Institute of the Ural Branch of the USSR Academy of Sciences, VSEGEI, the Institute of Geology of the Komi Scientific Center, and Perm and Kazan Universities, organized the International Geological Congress on the "Permian System of the Earth", in which more than 500 geologists, including 90 participants from the USA, Canada, a number of countries of Western Europe, Central Asia, China. This event was marked with a commemorative medal (Fig. 4, 5). In June 2009, a memorial sign to R. Murchison and his colleagues was erected on Chusovaya river near Chusovoye village, on the initiative of the Ural-Scottish Society of Yekaterinburg, a memorial sign was erected to R. Murchison and his colleagues (Fig. 6) and a field conference with a series of reports was held. Next year, 2011, it is planned to celebrate the 170th anniversary of the international geological expedition.

This concludes the introductory part of the publication and returns to the disclosure of the topic indicated in the title of the publication, for which we present some excerpts from the book "Murchison's Wandering in Russia" recently published by the British Geological Survey (Murchison's Wanderings in Russia, 2004). The book was kindly donated to us by Michael Stephenson, an employee of the British Geological Survey, who was a participant in the International Field Symposium "Layered stratotypes of the lower Permian system in the Urals". The symposium was held by the Laboratory of Stratigraphy and Paleontology of the Institute of Geology and Geochemistry of the Ural Branch of the Russian Academy of Sciences in July - August 2007.

The travel diaries of Sir P. Murchison, together with the editors' notes and rather numerous figures (Fig. 7.8), amounted to 475 pp. Attached to them is the Geological Map of European Russia and the Urals, compiled under the leadership of Murchison. We will confine ourselves to translating that part of the book, which contains the impressions of this remarkable geologist about the Urals and some cities (pp. 223–231). An overview of the results of Murchison's stay in the Urals is planned to be presented in the second publication. Murchison's original text is in italics.

**Yekaterinburg and surroundings**

*Yekaterinburg is home to 18,000 inhabitants, the majority of whom are miners and merchants, dependent in their activities on state mines. The chief director of the mountain corps, artillery general Glinka, is an all-powerful personality here. Glinka was absent from the city when we arrived, due to his departure to St. Petersburg, but returned the same night.*

*In the morning, a levee (general gathering - B.Ch.) was arranged, at which I was the centre of attention. When I entered the room, forty miners in uniforms with red collars surrounded me. Half an hour later the general appeared. He instantly recognized me from the group of guests, gave me various compliments and finally invited me to a personal dinner the next day, without levee. Then he walked around everyone and greeted (hello in the text - B.Ch.) with each participant in the meeting.*

*The city stretches along a wavy tract of considerable width on both sides of the small river Iset (in the text Issetz – B.Ch.), the flow of which is not visible, since the river is dammed up above the factory, forming a pond for its operation. As usual in Russia, the vicinity of the pond is a meeting place for residents.*

*The main street, crossing the lowland with the pond, is oriented to the east, and all other streets are perpendicular to it. Almost a third of the city is made up of whitewashed houses with green iron roofs. A small number of houses are brick, but the bulk of the houses are wooden, brown, low.*

*In general, the city amazes with a variety of green and white churches with their high bell towers. The administrative building (Management of the Ural mining plants. - B.Ch.) and the Mint are bright and lush buildings outside, like sparkling butterflies in the middle of the forest. In truth, the entire tract only partially passes through a natural forest. Gradually, all the old trees were cut down, since they had not survived since the time of Peter I. The forest, I think, is as updated as that of the Yankee cities (USA - B.Ch.), near the western border of the prairie and forest.*

*In Yekaterinburg, as much gold is mined as in all other cities in the Urals together. The amount of gold mined has not diminished significantly over time, although recovering the same weight requires processing more earth, more labour, and increased costs than previously.*

*When you look back from the city to the west, you will be surprised: "Where are these hills that you just passed through?" Indeed, the slopes of the terrain are so small that no ridges can be seen, and you are in an almost flat wooded area.*

*In addition to mining, the region also has a Mint, in which 19/20 of all kopecks produced in Russia are minted. The machinery of this venture is run by the Englishman Tait, a fat, good-natured "John Bull" who speaks broken English with a funny Newcastle accent. He spent many years here, hardly meeting his fellow countrymen, and forgot a good deal of his native tongue, being married to the good-natured "zharman", as he told me about his wife. In conversation, Tate barely made ends meet at the level of his primitive Danish, with Russian idioms and funny words, sometimes giving out such outright absurdities that I could hardly restrain myself not to laugh in his presence.*

*Tate visited numerous factories to install or repair machines and had many amusing incidents while traveling without a good route description, without maps, and with explanations of the route such as "you have to go to that farm and then to another."*

*Tate was my translator in this Asian-Russian mining capital; His Excellency General Glinka did not speak fluently in any language, which saved him (Tate - B.Ch.) when transferring from the disfavour of his superiors. In the same position was the colonel - the commandant, a very worthy good-natured gentleman, with whom I had dinner yesterday, and where Tate flaunted his speech effectively. Since Glinka spoke German, like me "aber schlecht" (German is very bad. - B.Ch.), we could still communicate somehow.*

*In addition to the Mint and mines, there is a large enterprise (Cutting Factory. - B.Ch.) for polishing decorative stone, whose products adorn the Imperial Palaces in St. Petersburg. The director of this enterprise was Colonel <omitted in the record> and the head of the Mining School. The two main water wheels, mounted by the aforementioned Tate, rotate, performing various operations, from sawing blocks to the first rough turning of the product. Small handwheels and hand tools help to perform delicate operations when turning vases and processing relief items such as cameos.*

*The base of the factory-made malachite vases is composed of a soft talc-like stone, somewhat similar to the talc shale from which Teimouth Castle is built, mined in the same area. This stone is widely used due to its softness and ease of processing. Thousands of pieces or tiles of malachite are glued onto the talc base (just as joiners do). The tiny cracks between them are filled with a green, wax-like mass made from crushed malachite, wax, etc. Then the mosaic surface is carefully polished.*

*Some of the largest vases cost the government less than RUB 30,000. (£ 1,500), including transport, labour, etc., as the labour of the imperial workers is low in value and the products are very cheap. It can be argued that vases could have been made here for sale for no less than £ 3,000–4000.*

*At our visit, a large vase of 9 feet (2.7 m - B.Ch.), made of Siberian aventurine with golden sparkles, was in the last stage of polishing. This breed (Siberian aventurine - B.Ch.) comes from Mount Taganay, one of the highest peaks in the Urals, located not far from Zlatoust. The block from which the vase and its pedestal are made originally weighed 360 pounds.*

*\*\*\*\*) Note from editors. To this, the following postscript was later made: "... this vase, it seems, was made of the same material as the large vase from the Kolyvan Mountains of Eastern Siberia sent to me by Emperor Nikolai."*

*In the process of manufacturing in the workshop there were also: a facing of a fireplace made of bluish-grey banded jasper, with projections for bell cords and other accessories for ease of use, coats of arms for the prince (prince - B.Ch.) Volkovsky (Volkonsky? - B.Ch.), cameos, etc.*

*The recently discovered straw-coloured mineral, phenakite, is very popular with the ladies of the Court, as it bears a great resemblance to diamond. Written granite is also very popular as resembles the pages of the Koran. I saw here rock samples with large crystals of corundum in mica schist from the vicinity of Miass.*

*Polishing is carried out with emery (which is mined 49 versts from Yekaterinburg) from the veins in the marble. It is calcined and mixed with calcined lime to a thick paste. It is the hardest substance in nature, and spinning wheels enable the creation of new products.*

*Did the Egyptians have such wheels? Could the many-armed Egypt, possessing only such a paste, create their miracles? Even now, when intense labour and a lot of time is still required with all the improvements to process these hard porphyrites and jaspers, how we should admire the Egyptian scale of the work!*

*The Russian hotel, or "gostiny dvor", is funny! I write this in one of the best and cleanest ones. My living room is furnished with green sofas on a well-painted floor. There are no curtains or shutters to reduce the glare of the six windows. This is where I receive my visitors. In the bedroom they pass through to come to me is my own small camp iron bed, many chairs and armchairs. The bedroom connects to another room, which has buffets with sweets, bottles of drinks and tea utensils.*

*In another wing of the room, my servant is located in a separate room. Thus, one person and his companion occupy the entire floor, the same length along the facade as the Reform Club (a famous building in London - B.Ch.). Everywhere everything is well whitewashed or painted, and I did not meet a single flea east of the Volga, as well as bed bugs and even single mosquitoes. It is indeed the cleanest country I have travelled in, with the exception of some well-to-do parts of England. It is also a region of great toilets.*

*No dinner in Yekaterinburg ends without champagne, which costs 18 shillings a bottle. After these dinners I was twice drunk: once at a reception at the commandant's, and this evening at the house of my young friend Koksharov's worthy parents \*\*\*\*\*).*

*\*\*\*\*\* (a well-known mineralogist, Murchison's travel companion in Russia, later a member of the St. Petersburg Academy of Sciences - B.Ch.)*

*It seemed to me that the population of this region is better managed than in other regions of Russia. Thefts are so rare that in the city of Verchon? - B.Ch., hardly one door is locked. The hospitality is so boundless that the inhabitants will never refuse bread and salt even to criminals who fled from Siberia.*

*What struck me especially was the complete disregard of people from the upper strata of society, even those living along the highways, for physical geography. At the same time, the peasants are good experts in the area. Not a single road in Russia is shown on the map correctly, and the smaller the scale, the more perfect the map. The most populated provinces of Russia and even the areas around the capitals and wealthy regions along the Volga do not have maps. I was rescued by the poor-quality Schubert maps, in which hundreds of small villages with long names merge together, confusing weak attempts to show anything on the ground, at least with indications of the direction of streams. \*\*\*\*\*\* Even this is done badly in most cases, and since no designations for the hills are made, you can never tell from such a map whether a river flows into a swamp or into a mountain range. A good map is a boon for the geologist, but this does not apply to Schubert's maps.*

*I was so tired of such poor products that I was really glad when we were east of the Volga and outside the range of these maps. Here I could use something similar to the map of the Urals and its adjacent territories drawn by Humboldt and his assistants in Berlin. This map, however, was too small to be used for detailed work, especially along the tract, where every mile "has its own tale." It is also defective in some areas, especially away from main roads. For example, between Malmadysh and Mamysh in Kazan province, significant factories with a population of several thousand are not marked, and the villages along the Kama are plotted with great errors.*

*At the Serginsky factory, south of the main road between Kazan and Yekaterinburg on the western slope of the Urals, I discovered that some rivers were not in place. But, even with all the defects, this map (Humboldt) was invaluable to me.*

*If I were the Emperor of Russia, I would have forced at least one thousand of my lazy officers in lace-trimmed uniforms to work and draw up a good map for the country, otherwise send them to study physical geography in Eastern Siberia.*

*With the exception of General Chevkin and a very, very few others, I have never met a person who is erudite in many ways, who knew how to handle maps. In reality, it only takes one hour of effort for the governor to make his way across the map along a well-travelled road. I can’t forget my surprise in Nizhniy Novgorod when the entire governor’s residence was searched for a map on which I could plot a route south of Moscow. This event took place in the rich commercial centre of Russia, the beautiful city of Nizhny Novgorod, in the governor's house.*

*Alas, after such fantastic information, I found out how broadly everything is understood here. For example, you can find people actively discussing whether such a remarkable place as Zlatoust is located on the western or eastern slope of the Urals. When it comes to roads, travellers here rely on smart peasants, hardy horses and sturdy tarantasses.*

*The roads shown on Humboldt's map may have existed in Peter's time, but they are already impassable on wheels, and every Russian from the lower or higher strata who travelled on them knows that the horse road is not a road. For example, the old highway to Siberia from Solikamsk through the ridge is currently used only in winter. Other roads actually used, for example, to Zlatoust, are not shown on the map.*

*\*\*\*\*\*\*) Editors' note: the following remark was made later: "I specially pointed out this great defect to the emperor on my return to St. Petersburg, and I hope that now there are good maps in European Russia."*

*Certainly, the devil himself was involved in the invention of the droshky. His Satanic Majesty used his influence to create this wheelchair.*

*As for me, an experienced fox hunter and cavalryman, I could not sit in them without fear, feeling the death of a part of my body, since my legs could not be stretched out or bent freely. It seems that this machine is specially made for the special short-legged race of bipeds.*

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