

STUDYING THE GEOLOGICAL STRUCTURE OF KRASNOYARSK AND THE SUBURBAN AREA

Tomasheva N.O.

Language supervisor V.I.Schepeleva
Siberian Federal University

The geological structure of Krasnoyarsk is complex, resulting from a long and varied geological history. A wide range of geological structures occur here varying from ancient Precambrian rocks to contemporary geological processes. We have seen this during our geological routes. Before starting the routes our group learned geological structure of the territory, the geography of the area, the orography and the hydrography.

Krasnoyarsk is located at the junction of the West Siberian Plain and the Altai-Sayan mountain- fold region on the right and left banks of the river Yenisei about 50 km east of Krasnoyarsk hydropower station.

The climate is sharply continental, with long cold winters and short, sometimes hot and dry summer. The average temperature in January is -15°C and $+18^{\circ}\text{C}$ in July. After the construction of the Krasnoyarsk hydroelectric climate changed and became more humid with frosty winters. In winter the soil freezes (sometimes up to 3 meters depth). It should also be noted that the temperatures, humidity and rainfall in reserve "Stolby" differ due to the isolation of the area.

In the region of Krasnoyarsk we observed different zones, some of which are coniferous forests (mountain taiga zone), deciduous and mixed forests (suburban areas) and forest, located primarily to the west and southwest of the city. The most common are pine, spruce, larch, fir, birch, aspen, ash, cherry, in wetlands and willow along rivers. There are many widespread plants and also many endemic herbs like orchid of Venus shoes and others.

Wildlife is widely represented in the reserve and in the suburbs e.g., bears, moose rodents (squirrels, chipmunks, squirrels), birds (eagle, hawk, cuckoo).

Topography of the area is varied and heavily dissected: in the south the foothills of the Eastern Sayan, large area (~ 47 ha) belongs to the State Reserve "Stolby".

The relief of the left-bank and right- bank of the Yenisei valley varies considerably. On the left bank the maximum mark is on Nikolayevskaya Sopka, the erosion here is widely developed. On the right bank the relief is more sublime, the highest point is on Black Sopka (691 m), the top of the ridge Torgashinsky is 580 m.

We observed technogenic relief in the city and the suburbs, many sites were leveled and terraced ledges were created (left-bank embankment).

The geological structure of Krasnoyarsk includes stratified formations of varied composition, the origin and age are from Riphean to Quaternary. Late Riphean deposits occur mainly in the southwestern and western parts of the area.

Description of Quaternary sediments contained genetic types. Almost all kinds of deposits were observed in our routes but more often we came across alluvium, mainly along the Yenisei River.

Terrace formation of the Yenisei has been going since Eo-pleistocene to our days. Actually eo-pleystotsene includes two terraces, IX Badalykskaya and Hudonogovskaya VIII at the site which is now the main academic buildings of Siberian Federal University.

Torgashinskaya terrace is the lowest Pleistocene alluvium VII, here are located the Academic town and the Campus on the left bank of the Yenisei. On the right bank it stretches from Bazaikha to the cement plant. The total thickness of the seventh terrace deposits is 110 m.

Alluvial deposits VI of Sobakinskaya floodplain terrace have a relatively small distribution, mainly in the left bank of the Yenisei River east of Krasnoyarsk. The height of this terrace is 100-120 m, thickness of alluvium here is about 10 m. From the surface of the terrace there lies loess loam and below the sands with pebbles and small boulders.

Alluvial deposits V-IV floodplain terraces of the Yenisei are not very developed. In the suburbs of Krasnoyarsk V Kuznetsovskaya terrace is mainly composed of Devonian sediments. IV terrace Berezovskaya is widely presented on the left bank in the mouth of the Kacha to the aluminum smelter. To a depth of 1.5-2 m the terrace is composed of loess loam, sandy loam and small and medium-grained sands with rare pebbles below. The thickness of the IV terrace alluvium is 35 m.

The III Krasnoyarsk terrace is significantly developed, it is the city center. The terrace is accumulative, it is composed mainly of gravel with sand lenses.

Alluvial deposits of I-II Yenisei floodplain terraces are composed of sandy loam, clay, silt, sand and gravel, as we saw on the bank of the Yenisei near the village Udachny. The absence of large boulders in the modern alluvium can be explained by the construction of the Krasnoyarsk hydroelectric power station, which serves as a barrier for large debris.

Fluvial deposits are widely occurred in Krasnoyarsk and its suburbs. These are river sediments in the Bazaikha, Beryozovka, Karaulnaya, Kacha, Sobakina etc. Their composition varies from coarse gravel to silt and fine-grained sand and sandy loam.

Igneous rocks in the vicinity of Krasnoyarsk are different in composition of rocks formed during the time interval from the Late Riphean to Early Devonian.

On the right bank of the Yenisei in the route "Blue Hill" on the southwestern foot of Vyshka hill we watched ultrabasic rocks of the complex gone through serpentinization and mylonitization, such as serpentine with sliding mirrors, and serpentinized ultramafic rocks with bronzite crystals. Small bodies of ultrabazite form chains of two or more elongated protrusions lenticular bodies, their thickness is 100-200 m. One of the biggest is Bazaihsy massif (5 sq. km). All protrusions consist of schistose serpentinite of dark green and black color, sometimes contain pyroxene. We could see serpentine outcrops on the left bank of river Yenisei above the village Udachny, opposite Pioneer island.

Bakhtin volcanic complex is composed of sills and dikes of fine and medium gabbro. Contact dikes are sharp and tearing, consonant with the host sediments. This could be seen in the route "Syenite quarry" on the right bank of the Bazaikha. We took some samples gabbro, including gabbro with streaks of calcite in Moss Creek. The Late Riphean age is accepted conventionally. Inside the syenite quarry we took samples of coarse syenite with veins and fine grained syenite.

Syenite of Stolbovskaya intrusions are widely used as facing stone for exterior and interior of buildings in Krasnoyarsk, in manufacturing sites, road curbs and stairs.

Black Sopka mountain is visible from many parts of Krasnoyarsk and we observed during all the routes. It is 691 m high and is located 8 km south-east of the city of Krasnoyarsk. It is a subvolcanic intrusion. In the shape it is a rod 1.2-1.5 km dia. Its central part is composed of olivine dolerite and tinguaitami in peripherals. The age of the solid of Black Sopka is Devonian. It can be confirmed by comagmatic trahiodolerite of Karymovskaya Formation of the Early Devonian and by Ar-Ar method of 402-406 million years.

In the geological structure of Krasnoyarsk there were determined three distinct structural floors. The bottom floor is a pleated complex structural formation of late Precambrian and Lower Cambrian. The medium floor is a transitional structure forming superimposed troughs made of volcanic and sedimentary rocks of the Middle-Upper Ordovician, Devonian and Lower Carboniferous. Finally, the upper floor contains the platform structure of gently dipping Mesozoic sediments.

The formation of the district structure has been going for a long time through five stages.

Precambrian: sediments of Late Proterozoic, crushing rocks into folds and disturbance of faults.

Lower Cambrian: dislocated rocks of the Lower Cambrian and Precambrian formations subjected to additional violations and schist.

Middle Paleozoic: outpouring of effusive and the subsequent introduction of alkali granite, syenite, dolerite (the North Minusinskaya and Rybinskaya depressions began to form after that).

Late Paleozoic: gentle folds of Devonian and carbon deposits with flexures involving discontinuities formations.

Mesozoic- Cenozoic: characterizes all further geological history of the area including the formation of the relief in the Neogene- Quaternary period.

Krasnoyarsk is rich in minerals. Currently operated Torgashinskoe limestone deposit refers to the formation of Early Cambrian age. The limestone mined here is of high quality and meet the requirements for the flux and cement raw materials.

Mokhovskoye syenite deposit produces raw material for facing slabs and curb stone. This deposit is out of use now because it is located in the Krasnoyarsk State Reserve “Stolby”.

Marbles of Bazaihs koye deposit were formed as a result of contact metamorphism of carbonate sediments with syenite rocks. This marble is a good decorative facing material. Currently the deposit is out of use.

The deposits of clay rocks and sand and gravel accumulated on the terraces of the Yenisei are mostly worked out. Mining is carried out only in shallow pits.

During the geological routes we have learned to work with geological instruments, to navigate the terrain and attach to points on the map, to identify minerals and rocks in the field, to determine the elements of bedding rock formations using mining compass. We also observed numerous manifestations of endogenous and exogenous processes. On the basis of these observations and acquired knowledge we mastered the recordkeeping in geological routes and writing geological reports.

References:

1. Путеводитель по геологическим маршрутам в окрестностях г. Красноярска/ А. М. Сазонов, Р. А. Цыкин, С. А. Ананьев, О. Ю. Перфилова, М. Л. Махлаев, О. В. Сосновская. – Красноярск: Сибирский федеральный университет, 2010. – 212 с.

2. <http://ru.wikipedia.org/wiki/>

3. Сайт ФГБУ «Государственный природный заповедник «Столбы»:
<http://www.zapovednik-stolby.ru>

4. <http://www.multitrans.ru/>