EGU21-14977
https://doi.org/10.5194/egusphere-egu21-14977
EGU General Assembly 2021

Geological & information model of underground space as a museum object: the Rogoselga mine case (Russian Federation, Karelia)

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In addition to mining, underground space is widely used for various purposes - tunnels, underground storage facilities, etc. Very often, such structures are built specifically taking into account their use, less often they use the developed space. At the same time, the museum space is perceived "as is."

The main difference between the museum mining space and other uses of mining is the conflict between the maximum preservation of the interiors of these workings (it should be authentic, that is, to contain previously used in this space technological, historical, cultural content) and safe, i.e., the geotechnical state should correspond to the safe stay of visitors. That is why the study of the sustainability of mining is becoming the number one task in such studies. The problem is compounded for abandoned mining operations, the operation of which was discontinued many years ago.

Some solutions were proposed during the study of the abandoned Rogoselga mine, located near a high-traffic highway 135 km from the city of Petrozavodsk, 4 km from the village of Kolatselga, Republic of Karelia, Russian Federation.

Underground production appeared in the process of hematite extraction, as the main raw material for the local ironworks in 1898. Mining was stopped in 1903 and, after several attempts to restore, was closed. This complex of workings is a valuable monument to the whole era of iron ore production in the southeastern part of the Fenno-Scandinavian Shield, in terms of historical and cultural points of view.

The underground space includes the remnants of preparatory rollbacks, as well as the remnants of the wasting chambers, the ore of which went by itself in the rollbacks and then on the gallery was delivered to the surface. The total length of the workings does not exceed 300 meters, with a diameter of 2 meters, and the thickness of the ore body in the chambers up to 3 meters.

Over more than a century, the underground area has been slightly transformed by the collapses of individual parts but has retained but some areas are in good condition. To evaluate the workings, some methods for assessing the underground space were proposed, including modern approaches to documenting the workings, assessing the sustainability of the vault, and individual preparatory works. The result is the development of a geological and information model of the

underground space, allowing to study stability by modern methods, including the finite elements method (FEM).

The small size of the work predetermined the methods used. The methodology used in photogrammetry has been adopted as a general technology of 3D modeling.

The work has led to the development of several solutions for small-diameter imaging and lighting technology, as well as to identify "weaknesses" in production and the possibility of using geotechnical techniques to assess the stability of the array.