

Introduction

Teptiivske granite deposit is located in the Rosynsko-Tikichska structural-facies zone on the left bank of the river Ros on the lands of Teptiivska village council of Boguslav district of Kyiv region, 1.5 km southwest of the village of Teptiivka, 1 km east of Boguslav (Figure 1).



Figure 1 Teptiivsky quarry on a Google Earth satellite map

Granites belong to the Uman complex of Paleoproterozoic (Figure 2); the age of granite formation according to the uranium-lead isotope method is 2050-2020 million years (State geological map of Ukraine, 2006). Development of the field began with the "Boguslavsky Granite Quarry" enterprise in 1969; In 2003, with the change of ownership to the limited liability company "Boguslavsky Granite Quarry" Production Enterprise, a new period of enterprise development began, the productivity of the quarry increased. The field is being developed in an open pit mine with drilling and blasting operations.

Development system - transport with parallel advancement of the mining front and the external location of the heaps of overburden. Mineral reserves are approved by the protocol of the State Committee for Reserves dated 19.10.2016 №3673 and amount to 17578.3 thousand m³. The annual productivity of the quarry is 340.0 thousand m³ / year, and mining works are carried out by four ledges 12-14 m high (+110, +100, +87, +73 m) ([http://eia.menr.gov.ua/...](http://eia.menr.gov.ua/)).

The main products are crushed stone, crushed stone-sand mixture, sand from crushing screenings, rubble stone (Figure 3).



Figure 2 General view of the quarry. Photo by M. Kovalchuk



Figure 3 Products of Boguslavsky Granite Limited Liability Company: a - crushed stone; b - gravel-sand-mixture; c - sand from crushing screenings; d - rubble stone (<http://www.bgkcomspec.com.ua/>)

The planned activity of the enterprise belongs to the second category of activities and facilities that may have a significant impact on the environment and are subject to environmental impact assessment in accordance with subparagraph 1 of paragraph 3 of part 3 of Article 3 of the Law of Ukraine "On Environmental Impact Assessment", namely : extraction of minerals, other than minerals of local significance, which are extracted by landowners or land users within the land plots provided to them with the appropriate intended use.

The environmental impact assessment procedure provides for the right and opportunity of the public to participate in such a procedure. Based on the analysis of space images from different times, the authors retrospectively monitored the change in the area of the geological environment of quarries disturbed by the quarrying of the Teptiivsky granite deposit by quarries during 1990-2020.

Method and / or Theory

The authors were able to get acquainted with the production activities and products of the enterprise, parameters and geological structure of the deposit, mineralogical and petrographic characteristics of granites directly in kind by visiting the quarry of Boguslavsky Granite Quarry Production Enterprise.

To determine the area of the disturbed geological environment, granite quarrying used space images from the United States Geological Survey (USGS) (<https://earthexplorer.usgs.gov/>) from 1990 to 2020. Space images from the Landsat 4-5, Landsat 7, Landsat 8, Sentinel 2 systems, which have the GEO.tiff format and spatial reference in the WGS-84 coordinate system, were involved in the study.

Vectorization of areas of disturbed geological environment and calculation of their areas was carried out according to Landsat 4-5 images (07/08/1990; 11/07/1992; 26/07/1994; 06/07/1996; 28/07/1998; 18/08 / 2000; 21/06/2002; 29/08/2004; 20/05/2008; 23/08/2010, 18/09/2011), Landsat 7 (07/05/2012), Landsat 8 (28/08) / 2015), Sentinel 2 (09/11/2018, 19/09/2020) in the QGIS software environment 3.14.

Results

Granites of the Teptiyivske deposit are mostly gray and pink-gray in color, medium-fine-grained, porphyroblast-like. Mineral composition of granites (Kovalchuk, M.S., Vergelskaya, N.V. and Liventseva, G.A., 2019) : plagioclase, potassium feldspar, quartz, biotite. Accessory minerals are represented by apatite, monazite, sphene, zircon, rutile. Clear apatite-sphen-zircon paragenesis has been established for accessory minerals.

The peculiarity of sphenes is their significant content of yttrium (up to 3129 g / t), niobium (up to 2575 g / t), thorium (up to 101 g / t), uranium (up to 107 g / t) (State geological map of Ukraine, 2006). Zircon content in granites up to 125 g / t (State geological map of Ukraine, 2006).

The mineralogical feature of granites is the presence of a hydrothermal zone of quartzization (Kovalchuk et al., 2019). Quartz is milky white, colorless; there are crystals of transparent rock crystal and scepter-like quartz, in which there are different generations, growing on top of each other (Figure 4). Pegmatite bodies are present in some parts of the deposit.



Figure 4 Hydrothermal silicification. Photo by M. Kovalchuk

A unique feature of granite deposits, in addition to its aesthetic appeal is a set of physical and mechanical parameters - the maximum possible strength, resistance to weather conditions, including frost resistance.

These physical and mechanical properties and compliance of granite with the first class of radioactivity allow to use it for all types of construction and finishing works without any restrictions. In particular, granites of the Teptiyivske deposit are widely used in monolithic construction of high-rise buildings, decoration of reinforced concrete structures, production of cobblestones for squares and streets, facade and interior cladding. It is also used to create monuments and memorials, memorial plaques and plaques, souvenirs, vases, elements of designer furniture and various interior decorations.

The dynamics of changes in the area of the disturbed geological environment due to the extraction of granites are presented in table 1.

The results of the study of changes in the area of the disturbed geological environment over the years and its trend are presented in Figure 5.

Table 1. Dynamics of change in area of disturbed geological environment due to extraction of granite

Year	Area, km ²	Change of area, km ²	Year	Area, km ²	Change of area, km ²
1990	0,434	0	2008	0,52	+0,022
1992	0,42	-0,014	2010	0,556	+0,036
1994	0,424	+0,004	2011	0,55	-0,006
1996	0,438	+0,014	2012	0,522	-0,028
1998	0,468	+0,03	2015	0,568	+0,046
2000	0,470	+0,002	2018	0,549	-0,019
2002	0,481	+0,011	2020	0,55	+0,001
2004	0,498	+0,017			

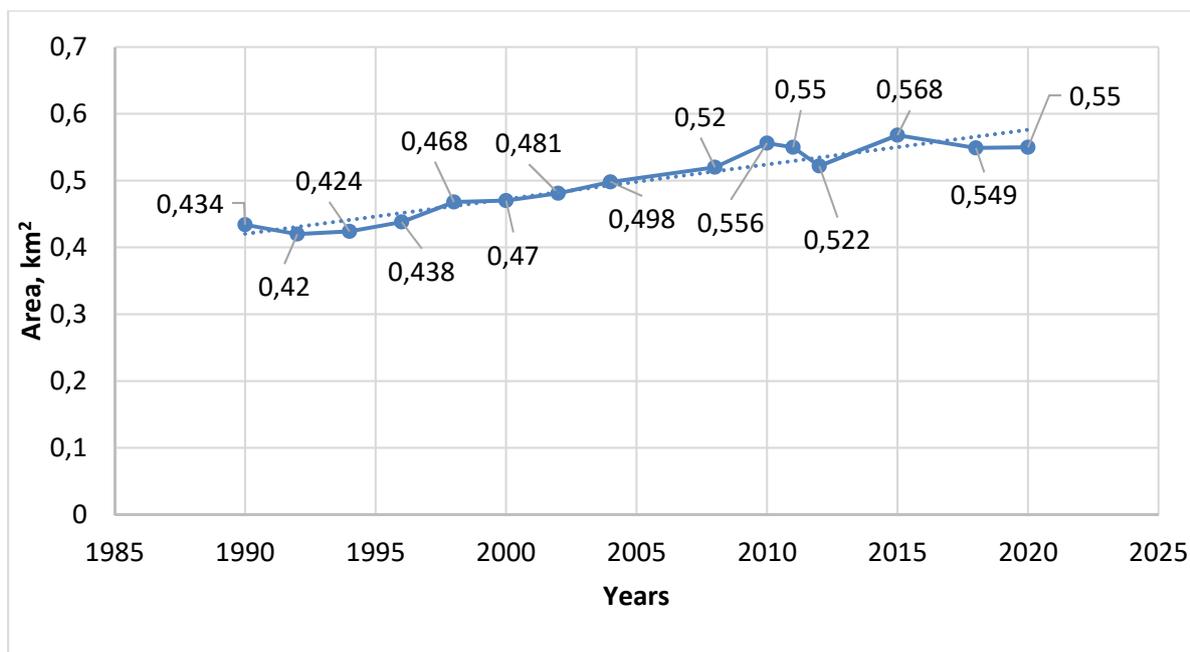


Figure 5 Dynamics of change in the area of the disturbed geological environment due to granite mining during 1990-2020

Conclusions

Retrospective analysis of remote sensing materials made it possible to assess the trends and dynamics of changes in the disturbed geological environment within the quarry field of the Teptiyevsky granite deposit. Compared to 1990, the area of the disturbed geological environment exceeded the value of the reference point since 1996 (+ 0.034 km²) and in the following years has been constantly increasing. In 2020, the area of disturbed geological environment compared to 1990 is greater by 0.0116 km² and is 0.55 km². Fluctuations in changes in the area of the disturbed geological environment are caused by the intensity of the production process in different years, as well as an increase in the extraction of useful components due to the deepening rather than expansion of the quarry field with the formation of terraced ledges. Samples with quartz mineralization have museum value.

References

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