

2. Alekseev, S.E., Repin, A.A., & Pyatnin, A.A. (2007). Creation and introduction into production of powerful DTH pneumatic hammers. *Fundamental problems of the formation of the technogenic geoenvironment*, 2 (2), 9-13.

3. Golovchenko, A, Pazynich, Yu, & Potempa, M. (2018). Automated Monitoring of Physical Processes of Formation of Burden Material Surface and Gas Flow in Blast Furnace. *Solid State Phenomena*, (277), 54-65. <https://doi.org/10.4028/www.scientific.net/SSP.277.54>

4. Kosolapov, D.V. (2009). Features of dynamic calculations of details of downhole pneumatic hammers. Proceedings of the III All-Russian conference "Safety and survivability of technical systems", 171-175.

5. Lipin, A.A. (2005). Promising pneumatic hammers for drilling wells. *Physical and technical problems of mining*, (2).

FUNDAMENTALS OF CREATING INNOVATIVE SYSTEMS OF MINERAL RESOURCES DEVELOPMENT ON THE MOON, MARS AND ASTEROIDS

MEDIANYK Volodymyr¹, MALASHKEVYCH Dmytro¹
¹Dnipro University of technology, Dnipro, Ukraine

Introduction. Human needs for resources are growing every year. Waste recycling and alternative sources of electricity will not be able to meet the growing needs of mankind. The number of useful resources on our planet, unfortunately, is limited [1, 2].

Purpose. Even now, some of mineral resources are more difficult to extract than, say, 150-200 years ago. According to the UN, a 3-fold increase in resource use is projected by 2050. In the long run, man will have to explore new resources outside the Earth. The only place for new reserves of resources and energy is space. This could be the development of minerals from the surface of asteroids and other planets.

Methodology. The results of spectroscopic studies and chemical analysis of meteorites that fell to Earth give us the right to believe that asteroids and comets can find a variety of minerals, including nickel, iron, silicates, gold, platinum metals, water, frozen gases and more. Asteroids contain platinum group metals about 100 g/t, ie 10-20 times higher than in the richest open deposits in South Africa or any other country in the world. The development of asteroids is now not only closer than we think, but, according to experts, in the future this direction will dominate the entire industry.

Keywords: design, planning, engineering solutions, innovations, mineral resources development systems, space mining

References

1. Бондаренко, В.І. Медяник, В.Ю., Руденко, М.К., Ковалевська, І.А. (2020) Вугільна шахта : підручник. Д.: НТУ «ДП», 357 с.

2. Lozynskiy, V., Medianyuk, V., Saik, P., Rysbekov, K., & Demydov, M. (2020). Solutions multivariate about designing new levels of coal mines. *Rudarsko Geolosko Naftni Zbornik*, 35(2), 23-32 <https://doi.org/10.17794/rgn.2020.2.3>