

MAIN DIRECTIONS OF INNOVATION DEVELOPMENT MINING COMPLEX

Yuri V. Lebedev

Ural State Mining University, 30, Kuibyshev St., Yekaterinburg, 620144, Russia, D. Sc., Professor, Department of Environmental Engineering, e-mail: taranova@ukr.net

Rudolf N. Kovalev

Ural State Forestry University, 37, Sibirska Trakt, Yekaterinburg, 620032, Russia, D. Sc., Professor, e-mail: kir9624@yandex.ru

Larisa N. Oleynikova

Ural State Mining University, 30, Kuibyshev St., Yekaterinburg, 620144, Russia, D. Sc., Assistant, Department of Environmental Engineering, e-mail: nikolar07@mail.ru

In the consideration of the facilities of the mining complex there was used an approach which applied the interdisciplinary method based on accounting of the ecological, social, economic, technological factors. The «system of subsoil use» is considered as an aggregate of developed subsoil areas and industrial production. They are united by the flow of energy, substance and information between themselves, with civil society and with natural environment. There were considered two conditions for innovative development of mining complexes: formation of long-term motivation of subjects of economic activities and creation of long-term loan mechanisms. The main directions of innovative development of mining and industrial complexes are substantiated: the creation of new technologies for the extraction of minerals, advancing the world level in a number of studies, the development of public administration, the use of technogenic deposits and the restoration of damaged ecosystems, the digitization of subsoil processes, and the involvement of society in the organization of subsoil use.

Key words: mining complex, subsoil use system, innovative development, new technologies, world level, state management, minimization of environmental violations, technogenic deposits, digitalization.

REFERENCES

1. Kozlovskiy, E. A. (2015). Natural resources in the economy of Russia and in the world. *Gornyy zhurnal [Gornyi Zhurnal]*, 7, 47–52 [in Russian].
2. Order of the Ministry of Industry and Trade of the Russian Federation dated May 5, 2014 No. 839. Approval of the *Strategy for the Development of ferrous metals industries* for 2014–2020 and for the future until 2030. Approval of the *Strategy for the Development of non-ferrous metals industries* for 2014–2020 and for the future until 2030. Retrieved from ConsultantPlus online database [in Russian].
3. Natalenko, A. E., Pak, V. A., & Stavskiy, A. P. (2015). The basic directions of development of the mineral-raw-material base of the Russian Federation. *Mineral'nye resursy Rossii. Ekonomika i upravlenie [Mineral Resources of Russia. Economics and Management]*, 1, 126–134.
4. Glaziev, S. Yu. (2009). World economic crisis as a process of substitution of technological modes. *Voprosy Ekonomiki [Voprosy Ekonomiki]*, 3, 26–38 [in Russian].
5. L'vov, D. S. (2002). *Ekonomika razvitiya [Development economics]*. Moscow: Ekzamen Publ., 511 p. [in Russian].
6. Lebedev, Yu. V., Kokarev, K. V., Aref'ev, S. A., & Krylov, V. G. (2017). Associative links in the field of subsoil use. *Izvestiya vuzov. Gornyy zhurnal [News of the Higher Institutions. Mining Journal]*, 8, 108–115 [in Russian].
7. Lebedev, Yu. V., Kovalev, R. N., & Kokarev, K. V. (2018). *Tekhnologicheskoe prognozirovaniye innovatsionnogo razvitiya nedrodobivayushchego sektora [technological forecasting of the*

- innovative development of the subsoil mining sector]. Ekaterinburg: UGGU Publ., 222 p. [in Russian].
8. Shtyrov, V. A. (2018). Arctic. Greatness of the project. *Zavtra [Tomorrow]*, No. 5-7, P. 6 [in Russian].
 9. Boldyrev, Yu. Yu. (2013). *Kak izbezhat' grazhdanskoy voyny [How to avoid civil war]*. Moscow: Algoritm Publ., 240 p. [in Russian].
 10. Yushina, T. I., Petrov, I. M., Grishaev, S. I., & Chernyy, S. A. (2015). International rare earth metals market and processing technologies: State-of-the-art and future prospects. *Izvestiya vuzov. Gornyy zhurnal [News of the Higher Institutions. Mining Journal]*, 2, 59–64 [in Russian].
 11. Vasilevskaya, M. A., & Khabarov, V. V. (2014). Oil and gas potential of Bazhenov formation of Irtysh-Turtass zone of the south of the Tyumen region. In *Sbornik materialov Mezhdunarodnoy nauchno-metodicheskoy konferentsii [Proceedings of International Scientific and Practical Conference]* (pp. 133–143). Khanty-Mansiysk [in Russian].
 12. Hotelling, H. (1931). The Economics of Exhaustible Resources. *Journ. Polit. Econ.*, 39, 137–175.
 13. Sollou, R. M. (2000). *Ekonomicheskaya teoriya resursov ili resursy ekonomicheskoy teorii (lektsiya v chest' Rigarod T. Eli): T. 3 [The economics of resources or the resources of economic. Srichard T. Ely lecture: Vols. 3]*. V. M. Gal'perin (Ed.). St. Petersburg: Ekonomicheskaya shkola Publ., 21 p. [in Russian].
 14. Gorshkov, V. G. (1995). *Fizicheskie i biologicheskie osnovy ustoychivosti zhizni: T. XXX VIII [Physical and biological foundation of the life sustainability: Vols. XXX VIII]*. Moscow: VINITI Publ., 472 p. [in Russian].
 15. Borzakovskiy, B. A., Grinberg A. Ya., & Tolmachev B. N. (2012). Experiences of liquidation of failure in earth's surface over a flooded potassium mine. *Izvestiya vuzov. Gornyy zhurnal [News of the Higher Institutions. Mining Journal]*, 2, 65–68 [in Russian].
 16. Boldyrev, Yu. Yu. (2019). Women's «extremism». *Literaturnaya gazeta [Literary newspaper]*, No. 9 [in Russian].
 17. Chernyshev, N. M. (2012). How to protect Hopper. *AiF-Chernozem'e [AiF- Chernozem region]*, No. 49 [in Russian].
 18. Lebedev, Yu. V. (2017). *Ekologicheski ustoychivoe razvitiye territoriy: patrioticheskiy vzglyad sovetskogo cheloveka [Environmentally sustainable development of territories: patriotic soviet look]*. Ekaterinburg, 472 p. [in Russian].
 19. Podinovskiy, V. V., & Gavrilov, V. M. (2016). *Optimizatsiya po posledovatel'no primenyaemym kriteriyam [Optimization on consistently applied criteria]*. Moscow: Lenand, 192 p. [in Russian].
 20. Kaplunov, D. R. (2014). Theory basis of designing of subsoil mastering: formation and development. *Izvestiya vuzov. Gornyy zhurnal [News of the Higher Institutions. Mining Journal]*, 7, 49–53 [in Russian].
 21. Mawby, Maurice R. W. J. (2013). *Australasian mining and metallurgical operating practices. The Sir Maurice Mawby Memorial. Vol. 2*. Carlton. Vic.: Australasian Institute of Mining and Metallurgy Publ.
 22. Dubinski, J. (2013). Sustainable Development of Mining Mineral Resources. *Sustain. Min.* 12(1), 1–6.
 23. Trubetskoy, K. N. (2018). Addressing the challenges of *environmentally balanced mining of ground-based geotechnology*. *Izvestiya vuzov. Gornyy zhurnal [News of the Higher Institutions. Mining Journal]*, 6, 17–24 [in Russian].
 24. Adibi, N., Ataee-pour, M., & Rahmankour, M. (2015). Integration of sustainable development concepts in open pit mine design. *J. Clean. Prod.*, 108, Part A, 1037–1049.

25. Zubov, V. P. (2017). Resource-saving technologies of underground development of stratified deposit. *Izvestiya vuzov. Gornyy zhurnal [News of the Higher Institutions. Mining Journal]*, 4, 49–56 [in Russian].
26. Davis, G. A., & Newman, A. M. (2008). Modern strategic mine planning. In Proceedings of the Australian Mining Technology Conference, AusIMM (pp. 129–139). Carlton, Australia. Retrieved from http://inside.mines.edu/~gdavis/Papers/CRC_Mining_Conference_Paper.pdf.
27. Erzurumlu, S. S., & Erzurumlu, Y. O. (2015). Sustainable mining development with community using design thinking and multi-criteria decision analysis. *Resources Policy*, 46(1), 6–14. Retrieved from <https://doi.org/10.1016/j.resourpol.2014.10.001>
28. Talvivaara sotkamo mine – bioleaching of a polymetallic nikel ore in subarctic climate. (2010). *Nova Biogeotechnologica*, 1, 7–14.
29. Nazarova, Z. M., Kas'yanov, V. A., Kalinin, A. R., & Desyatkin, A. S. (2018). Prospects for geologic exploration in Russia: Western way or native development model? *Izvestiya vuzov. Gornyy zhurnal [News of the Higher Institutions. Mining Journal]*, 11, 42–47 [in Russian].
30. Kubarev, M. S., Strovskiy S. V., & Balashenko V. V. (2017). Classification of technogenic mineral formations as a condition of waste management. *Izvestiya vuzov. Gornyy zhurnal [News of the Higher Institutions. Mining Journal]*, 6, 31–40 [in Russian].
31. Barkhatov, V. I., Dobrovol'skiy, I. P., & Kapkaev, Yu. Sh. (2015). *Ratsional'noe ispol'zovanie prirodnykh resursov Chelyabinskoy oblasti [Rational use of natural resources of the Chelyabinsk region]*. Chelyabinsk: ChGU Publ., 265 p. [in Russian].
32. Veduta, E. N. (2018). Rationalization. *Zavtra [Tomorrow]*, No. 33 [in Russian].
33. Evtushenko, S. (2019). Development or cyber robbery? *Zavtra [Tomorrow]*, No. 6 [in Russian].

Received 25.04.2019

© Yu. V. Lebedev, R. N. Kovalev, L. N. Oleynikova, 2019