

УДК 550.42:504.064.2.001.18

ECOSYSTEM RESPONSE TO MINING IMPACT  
IN A SHARPLY CONTINENTAL CLIMATE

Yana B. Legostaeva \*, Anna G. Gololobova

*Institute of Geology of Diamond and Precious Metals,  
Siberian Branch of the RAS (IGDPM SB RAS), Yakutsk, Russia*

Currently, the scale of mineral development is rapidly increasing, leading to environmental pollution. Therefore, there is an urgent need to study the comprehensive response of the ecosystem to increasing anthropogenic pressure. To identify the geoecological response of soils in areas where primary diamond and gold deposits are being developed, the content of potentially toxic elements (Pb, Ni, Mn, Cd, Co, Cr, Zn, Cu, and As) in the soil cover was analyzed within the industrial sites of the central Yakut diamond province, Western Yakutia (Aikhalsky and Udachny Mining and Processing Plants), and gold deposits in the Central Aldansky district, Southern Yakutia (Chulkovskoye and Gladkoye mining and processing plants). The soil cover contamination assessment was conducted based on calculations of geochemical coefficients – concentration ( $K_c$ ), contamination ( $PI$ ), potential environmental risk factor ( $E_r^I$ ), and integral indices – improve Nemerov index ( $INI$ ), contamination load ( $PLI$ ), total soil cover contamination index ( $Z_c$ ), and potential environmental risk ( $RI$ ). Soils of the diamond province are characterized by higher Mn, Ni, Cr, and Zn contents with relatively high variability. Industrial sites of gold ore deposits are characterized by higher concentrations of Pb, As, and Cd. High and anomalous concentrations of elements were identified in soils of impact zones, forming areas of superimposed man-made anomalies. High-risk areas are localized in areas of waste rock dumps, tailings ponds, along slurry pipelines, and other man-made objects of mining and processing plant industrial sites.

<https://doi.org/10.46991/PYSUC.2026.SI1.073>

**Keywords:** soil pollution, potentially toxic elements, bulk forms, kimberlite field, mining and processing plant, Yakutia.

**Acknowledgment/  
Funding:** *This work was carried out within the framework of the State Assignment project of the Diamond and Precious Metals Geology Institute FUG-2024-0007 “Mantle magmatism, lithosphere evolution and ore bearing capacity of the eastern part of the Siberian Platform, geoecology of subsoil use”.*

---

\* **Corresponding Author:** Yana B. Legostaeva, Ph.D. of Geoecology, Biogeochemistry, Ecology of Permafrost Landscapes, Geochemistry of Permafrost Soils, Laboratory of Geoecology and Biogeochemistry, Diamond and Precious Metal Geology Institute SB RAS, Lenin str., 39, Yakutsk, Russia. E-mail: [ylego@mail.ru](mailto:ylego@mail.ru)