COMPREHENSIVE MINERAL-EXPLORATION/EXPLOITATION OF ORE DEPOSITS, WITH SOME NEW TECHNIQUES, VALUE-ADDITION AND CREATION OF WEALTH FROM WASTE

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Abstract

Mineral-Exploration/-Exploitation (MEE) is presently carried out to recover the main product(s) of ores. In order to make MEE more profitable, holistic and sustainable for longer periods at less cost, it should be made comprehensive so as to recover all the possible, extractable and useful products from ore deposits, viz., main-, co- and by-products, together with value-addition and creation of wealth from mine-waste and tailings, besides Refilling – Recycling – Reuse (R3) of waste and used water precluding environmental degradation. With this objective, some new techniques are described, which, along with the currently used routine techniques, are recommended for adoption during MEE. These include: (i) ‘Unmanned Aerial Vehicle’, Drone-borne geological and geophysical surveys instead of costly, risky and high infrastructure-demanding ‘Manned Aircraft-based Systems’; (ii) Fully characterizing bulk ores, including the ore and gangue minerals, by microscopic, X-ray diffraction, chemical and Electron Micro Probe techniques; (iii) Use of low-cost, sensitive geophysical ‘Luminescence’ techniques to discriminate mineralized from barren zones and also indicate extension of mineralization in the contiguous areas; (iv) Adoption of less conventional drilling techniques like sonic-, horizontal-, wire-line- and logging-cum-drilling, followed by correlation of drill-depth of core with host-rock, mineralogy, alterations, colour, texture and ore-grade for better evaluation of mineralized zones; (v) Mechanised and digital mining with real-time survey and use of blockchain technology for fast, ore-band specific, cost-effective, with reduced generation of waste during mining; (vi) Synergizing mineral-, chemical- and nano-technologies for high-degree, cost-effective extraction, purification and recovery of all possible main-/co-/by-products; (vii) Evaluation of resources of high-value and strategic metals like Au, Ag, PGE, REE and Rare Metals in ore minerals, and R & D for both their extraction and present and future use in high-tech industries; (viii) Value-Addition operations:(ix) Wealth creation from waste; and (x) R3 of mine-waste - tailings–mine-water to minimise operational cost and environmental degradation, besides rehabilitation of displaced families on and possible use of mined land for agriculture.

Keywords: Mineral Exploration/ Exploitation, ore deposits, new exploration techniques, value-addition and wealth from waste.