Sustainable Development of Minerals and Metals

INTRODUCTION

The sustainable development of minerals and metals may seem like a contradiction to many people as they are not renewable resources as most would define the term. A productive, economic orebody can be composed of a few parts per million (gold) to a few percent (lead, zinc) mineral or metal, with the remainder being residue of no economic value. Production processes can have undesirable environmental consequences if not properly controlled.

Life without minerals and metals, however, is inconceivable. Of the ninety-two naturally occurring elements, seventy are metals. These substances have been part of human activity since particles of native copper were first hammered into simple tools about 6000 BC. Today we need minerals and metals for ever widening purposes. Industrial minerals such as mica are essential components of advanced industrial materials. Agriculture needs minerals-based fertilizers. Industries depend on metals for machinery and concrete for the manufacturing plants necessary for industrialization. No aircraft, automobile, computer, or electrical appliance can function without metals. Electrical power supply is dependent on copper and aluminium. Titanium is critical for aircraft engines and the supersonic aircraft airframes that have to withstand temperatures up to 400°C; and a world without the silicon chip is now unimaginable.

Metals are naturally occurring, persistent by definition, and ubiquitous in the environment. They vary in concentration depending on geology and environmental factors. They enter the atmosphere, the hydrosphere, and the biosphere from both natural sources (the weathering of rocks, volcanic eruptions, ocean spray) and anthropogenic sources. Many minerals and metals, however, are also required by plants and animals,