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Mineral exploration in regolith-dominated terrains: considerations, challenges and new approaches

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Exploration through transported cover is becoming one of the fundamental challenges for the minerals industry in this century. The overall increase in demand for commodities driven by a growing population and an increasingly affluent, technology-based society coincides with the decrease in world-class ore deposit discoveries in the last three decades. This situation is the driving force for restructuring mineral exploration paradigms. New technologies and methods are being developed and, as a consequence, regions that were considered to be unfavourable for ore deposit exploration are now being reconsidered. Among these areas are vast deeply weathered regions called Regolith-Dominated Terrains (RDTs), formed under humid sub-tropical to tropical climates, many of which have extensive transported cover.

Nearly 25% of Earth's continental surface area currently has a humid tropical climate (Fig. 1). This figure increases when considering regions that have experienced such conditions in the geological past. This is shown by the occurrence of abundant nickel laterite and bauxite deposits within in now cooler high-latitude regions. RDTs are commonly found on major stable geological features such as cratons, continental lowlands and plateaus. In parts of Australia, Africa and China these features are currently experiencing arid conditions, and are blanketed by regolith and later sediments up to hundreds of metres deep. Understanding the evolution of these terrains requires a different approach than their counterparts in recently glaciated, dissected and/or juvenile settings.

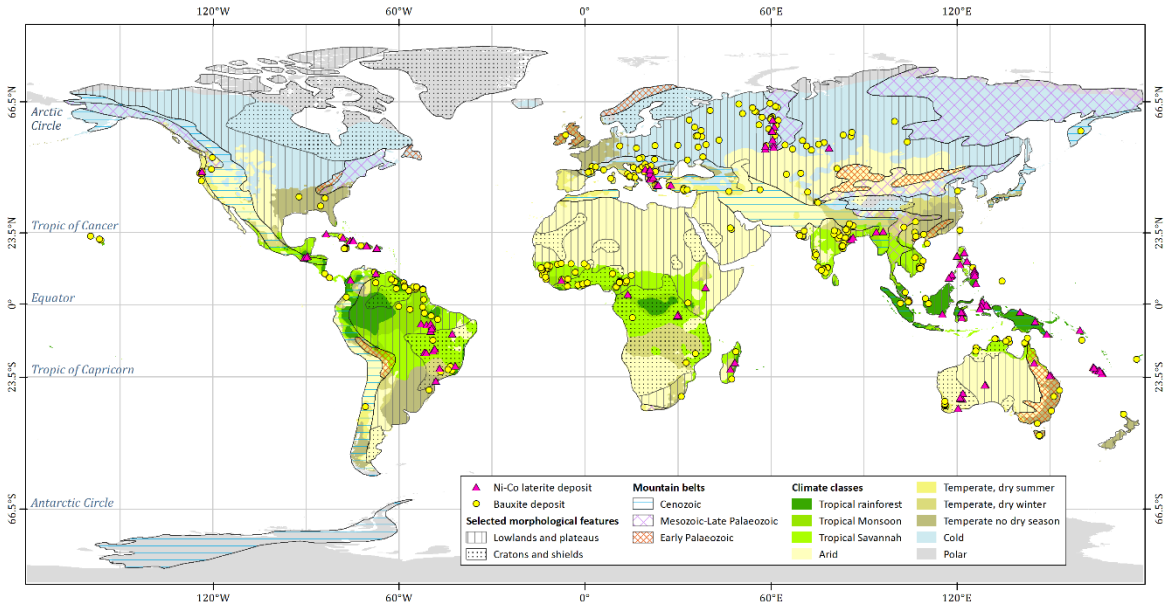

Figure 1: Main climatic domains showing the location of the principal Ni-Co laterite and bauxite deposits.

In RDTs, the use of geophysical datasets such as magnetics and gravimetrics has dominated the mapping of basement geology before subsequent drilling is carried out. In addition, subject to data density and the depth of ground penetration (>400 m), airborne electromagnetics can be a powerful tool to correlate the geology between known stratigraphic cover profiles. This has the potential to significantly improve the cover architecture reconstruction in 3D, which has important implications for describing landscape and regolith evolution and, therefore, for interpreting landscape geochemistry. Mineral exploration predictive and descriptive models in RDTs require the incorporation and integration of multi-parametric datasets (geophysical, geology, geochemical and landscape evolution) for specific geological context and landscape frameworks.