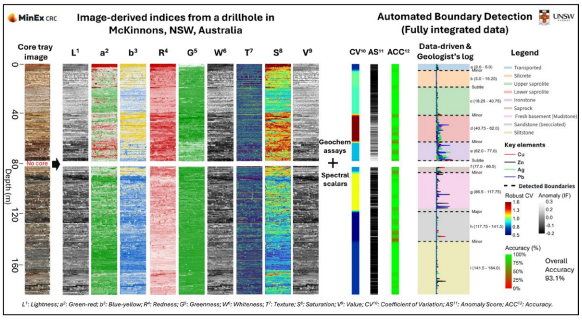
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Can image-derived lithological indices add value to geochemical interface detection?

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Geochemical and mineralogical datasets acquired from drill cores are routinely used to define lithological interfaces, alteration boundaries and limits of significant anomalous intervals. However, boundary detection can still be affected by variable sampling density, mixed regolith signals and subjective interpretation of boundaries in drill logs. Weathering intensity and regolith composition can produce systematic colour shifts that are detectable in photographs, often aligned with chemical transitions. Different components within a weathering profile, including transported cover, duricrust, saprolite and saprock commonly show distinct brightness and hue responses linked to iron oxides, clay development, and leaching or induration, which can coincide with geochemical breakpoints and critical zone interfaces that may be indicative of concealed mineralisation influenced by pH variability and redox.

This research introduces an integrated workflow schema that combines image-derived lithological indices extracted from core tray photographs with an objective, automated boundary detection framework to test whether colour and texture signals add measurable value to interface detection in regolith and fresh bedrock. The workflow generates reproducible and continuous downhole indices from core images such as perceptual brightness, colour ratios (e.g., redness, greenness and whiteness proxies), edge and texture metrics and masking to reduce glare and non-core artefacts. These indices can be then analysed alongside multi-element geochemistry and spectral mineral variables to detect interfaces using data-driven, consistent and repeatable rules, rather than conventional logging alone. The intent is not to replace geological logging, but to provide an independent set of quantitative logs that can refine or flag important intervals for detailed sampling and further analysis.

This approach was applied to multiple drillholes across covered terrains of Australia, where image-derived indices assisted in separating components of weathered profiles, distinguishing regolith overprint from unweathered bedrock, defining alteration zones and supporting reproducible identification of geological interfaces as a first-pass tool prior to lab-based analysis.