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The role of regolith and soil development with respect to assessing heavy metal contamination in urban soils with particular reference to iron.

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The role of regolith and soil development with respect to assessing heavy metal contamination in urban soils with particular reference to iron.
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Environmental assessors investigating brown and green development areas in inner and peripheral urban land in Australia routinely collect soil samples at prescribed depths, e.g. 0.1 – 0.5 – 1.0 – etc., in the soil profile. These sampling depths take no notice of the natural horizonation of a soil profile and hence are blind to geomorphological and weathering history of the site. In a continent like Australia, which largely has been spared the wholesale removal and re-deposition of soil and rock materials by Pleistocene glaciers, the vertical and lateral movement of heavy metals, including iron, nearly always explains the occurrence of elevated concentrations of As, Cu, Pb, V, Co, Cr, Zn and Ni in certain strata of the soil profile. The localised accumulation of these metals is normally controlled by changing redox potentials, which in turn are affected by translocation of clay and differences in soil hydraulic conductivity between A, B and C soil horizons. In other cases, the soil profile has operated like a chromatogram over many thousands of years. In Australian cities many urban soils do not have anthropogenic origins.
This paper will give some examples of misinterpreted contamination scares in relation to As, Ba, Cr and V that sometimes caused large financial budget overruns at developments in Melbourne. These examples are all based on practical consulting experience but elucidated by reference to the scientific literature.
Because of its huge spread, the greater Melbourne Metropolitan region extends from its western extremity with 450 mm annual rainfall to its eastern extremity with 900 mm, a distance of 70 km. A similar rainfall gradient may well have operated during much of the Quaternary, although during the Glacial phases the climate is thought to have been much drier. Likewise, the region spreads out over several very different “hard rock” lithologies from Quaternary basalt to Silurian sedimentary rocks and Devonian granites. However, there are landscapes in the region that probably date back to the Tertiary, 5-10 M years ago, without much change, and basalt landscapes 2 M years old.
The geochemical inheritance of this long period of weathering and soil formation on such different parent materials must be understood, or at least appreciated, to interpret the results of soil chemical analyses for environmental assessments. In Victoria, the majority of environmental assessors do not have a sound background in geomorphology, soil science and geochemistry but come from a geotechnical, civil or chemical engineering background, or have studied environmental science more generally. Therefore there are professional opportunities for those that have the desirable educational basis. Finally, assessment of potential soil contamination by heavy metals would be greatly assisted by including analytical methods that selectively dissolve sesquioxides to determine the proportion of total heavy metals that is released by this procedure. It can explain so much!