

Trends in the inorganic species budget of New Zealand soils (southern South Island): Natural versus anthropogenic change

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Lateral and vertical changes in inorganic species concentrations in New Zealand (southern South Island) soils have been studied using a new data set of 360 sites (8-km spaced) collected at two depths: 0-30 cm (A-depth) and 50-70 cm (B-depth). Samples underwent HNO₃-HCl-H₂O digestion before determination of 65 elements by dilution-ICPMS analysis. Sample splits were analysed by lab XRF as a lithium tetraborate melt and by field portable XRF as a < 2 mm sieved soil sample. A further sub-set has had Sr, S, C and N isotopic ratios determined. Results show many elements vary with, and correlate to, the underlying basement geology but there is also a decoupling of the near surface sample from the deeper sample for some elements (e.g. P, S, Mn, Pb, Cd, Se). The variation in these later samples can be explained anthropogenically. For example, variation in P, S and Mn in the A depth is apparent particularly in areas of high producing grassland, which have been fertilised in these elements for the past 130 years and Pb is more concentrated around urban centres where vehicle emissions and contaminants such as Pb-based paint are focussed. Arsenic is concentrated in the B-depth relative to the A-depth in historic mining areas northwest of Dunedin. This is attributed to natural As-bearing sulphides in mineralised veins and elevated As levels in the surrounding host rocks. There is also evidence in the survey for natural remobilisation of heavy metals (e.g. Cr, Ni, Co) where they are more concentrated in the floodplains of a major braided river system, the Oreti River, during Neogene-Quaternary erosion of ultramafic rock sources. The survey is showing natural and anthropogenic change affecting New Zealand soils.