THE SYNERGISM BETWEEN RADIOCARBON DATA AND MULTIVARIABLE CHEMICAL DATA FOR THE APPORTIONMENT OF ATMOSPHERIC PARTICLES

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Source apportionment of atmospheric aerosols is gaining increasing importance from the perspective of local and regional health and visibility impairment and from the perspective of global transport and global climate. Health effects arise from mutagens and carcinogens, such as certain of the polycyclic aromatic hydrocarbons; visibility and climatic effects relate to light scattering and absorption as well as cloud nucleation.

Carbon isotopes have become popular for apportioning anthropogenic and natural particle sources, and some work has been reported on univariate studies involving isotopes and chemical variables. In the present work, we shall demonstrate the important increase in understanding that comes from astute combination of ^{14}C data with multivariate chemical data. Such methods of analysis yield information on the number of primary particulate sources, the source signatures and a quantitative apportionment of source intensities.

^{14}C DATING OF MICRITIC $CaCO_3$ PEDOGENIC NODULES FROM VLEI DEPOSITS, HAASKRAAL PAN, SOUTH AFRICA

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Pedogenic calcareous nodules were ^{14}C dated from various stratified soil horizons in a meander of the Zoetvlei River in South Africa. The nodules occur stratified throughout 2–6 m of alluvial sediments. The nodules probably formed during drying episodes, and as a result of periodic lowering of water-table cycles in the phreatic zone. The archaeological evidence suggests the area was inhabited by Middle Stone Age (Orangian industry) and Early Stone Age (Acheulian industry) groups, antedating the last 40,000 years and beyond the range of ^{14}C. Twenty ^{14}C dates were run on the stratified nodular sequences, all yielding finite ^{14}C dates, suggesting contamination of older sediments with more recent carbonate.

Stained and impregnated nodules were thin-sectioned for petrographical analyses. Vugs and pores in the nodular micritic matrix were lined with secondary micrite and sparry calcite. XRD patterns of the nodules indicate the presence of the expandable chlorite montmorillonite-mica clay mineral group inherent in the soil matrix.

Uranium series dating of the nodular horizons from 14 sample sites reveals major drying episodes at about 44,000, 81,000 and 171,000 years. Older nodules retain a high porosity but are less permeable than the younger nodules. Stable ^{13}C and ^{18}O isotopes of older nodules record an isotopically lighter signal, suggesting cooler conditions affecting the groundwater reservoir.

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