RESEARCH NOTES

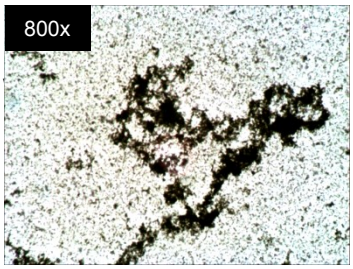
2017 Number 1

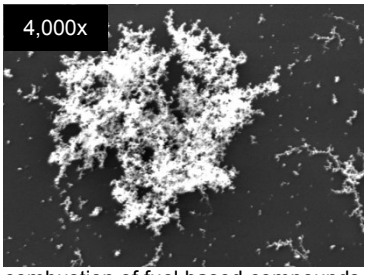
Environmental Analysis Associates, Inc.

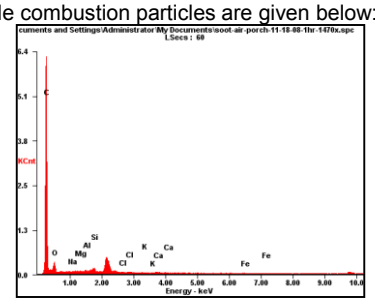
COMPREHENSIVE WILDFIRE COMBUSTION RESIDUE ANALYSIS

Wildfire combustion residue particles are a complex mixture of the organic combustion compounds, cellulose vegetation, “burned” soil, residual salts, and crystalline calcium and silica particles (phytoliths). Quantifying airborne and surface fire residue contamination is a multi-step process requiring a laboratory skilled in Optical Microscopy (Polarized Light & Reflected Light), Scanning Electron Microscopy, and basic pH chemistry analysis.

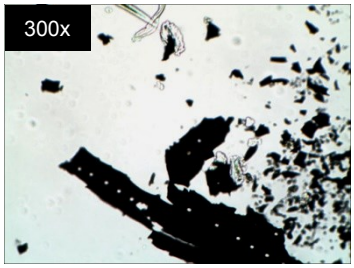
Wildfire combustion particles analyzed by microscopy methods are divided into 3 basic quantifiable categories (soot, char, and ash). There is also an “assemblage” of other particles associated with the burning of vegetation (leaves, bark, twigs, grasses, etc.) that can allow the differentiation of “wildfire” residues from other types of combustion sources. Example combustion particles are given below:

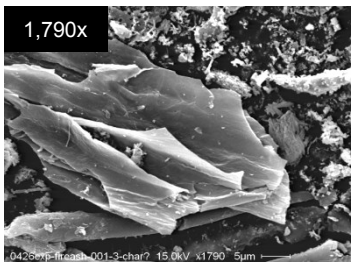


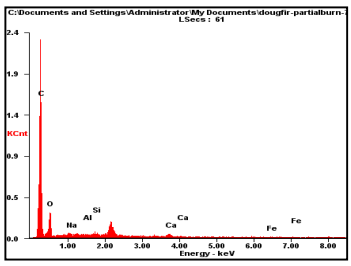




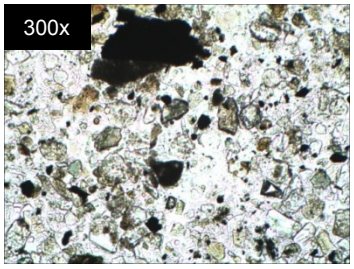
Aciniform agglomerates – Residues from the combustion of fuel based compounds

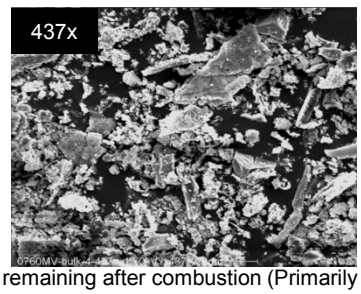


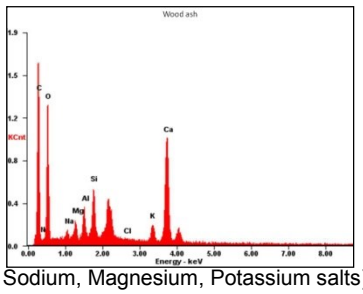




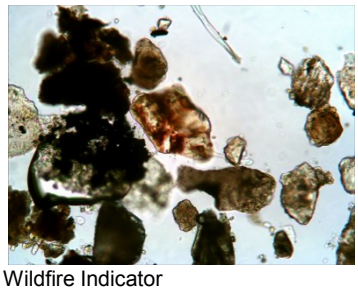
Char – Incomplete combustion of cellulose products





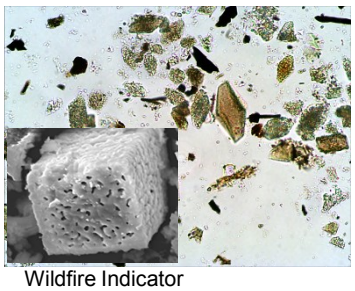


Ash – The residual mineral elements and salts remaining after combustion (Primarily Calcium, Sodium, Magnesium, Potassium salts)



Wildfire Indicator
Burned / carbonized soil clays / quartz

Wildfire Indicator
Burned Pollen



Wildfire Indicator
Plant phytoliths

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SAMPLING & ANALYSIS PROCEDURES FOR WILDFIRE RESIDUE ANALYSIS

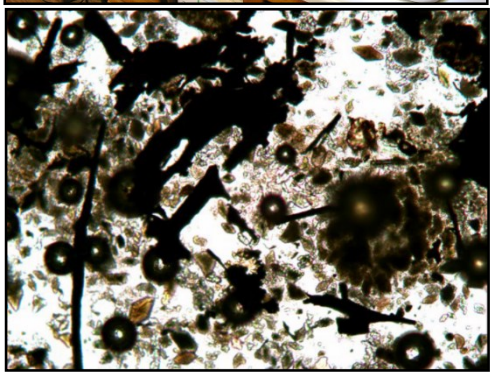
Surface samples are most appropriately collected by micro-vacuum or tape lift samples (Zefon bio-tape or clear cellophane tape). Air samples are collected on Zefon Air-O-Cell cassettes for Optical Microscopy Analysis, and Air-O-Cell CSI cassettes or 25mm polycarbonate filter cassettes for Scanning Electron Microscopy. The analysis results are reported as the percent ratio of combustion particles to other debris, and/or quantitative combustion particle concentrations per unit area or air volume.

STEP 1. Reflected light and polarized light microscopy analysis:

Qualitative evaluation of large char and ash particles using reflected light microscopy.

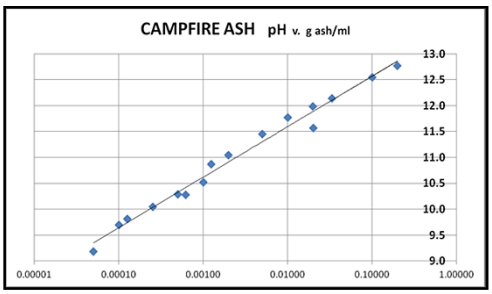
Quantitative percentages of fire / combustion residue particles (soot, char, ash, "wildland fire assemblage") using reflected & polarized light microscopy.

Classification of the results and distribution as normal background, "atypical" or potentially elevated, and the presence or absence of "wildfire" indicator particles.



STEP 2. Optional photographic documentation for legal and insurance cases –

A photomicrograph report of each sample can be provided showing the typical particle distribution and surface deposition density (tape-lift samples).



STEP 3. Optional dust pH analysis of bulk dust samples –

Evaluation of corrosion potential in bulk dust samples uses pH analysis (bulk dust samples only) to confirm the presence of soluble and conductive fire "ash" residues. When fresh "ash" is present in dust samples, the pH usually exceeds 9.0, and can be as high as 12.0.

STEP 4. Optional differentiation of dust source or origin –

Automated SEM / X-ray analysis can confirm the presence / absence of phytoliths, and their composition or potential origin. The chemistry of dust sample and percentages of Calcium oxide/oxalate or silica phytoliths and cation salts can also be quantified.

For your specific analysis needs, call Daniel Baxter @ 858-272-7747.

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