Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30693

# Ultrafine Particulate Matter and their Trace Metal Composition in Wildfire Smoke

**ALIREZA NAMAYANDEH**, JONATHON ISAAC HOWELL, FRIDA DANIELA GARCIA LEDEZMA, ALEXANDER S HONEYMAN AND SCOTT FENDORF

Department of Earth System Science, Stanford University, Stanford, California, United States

Wildfire smoke is a global source of particulate matter smaller than 2.5 microns ($PM_{2.5}$), leading to atmospheric transport of trace elements. $PM_{2.5}$ encompasses a wide-range of particulates with varying physical and chemical properties. Airborne nanoparticles (<0.1 μm) are capable of penetrating the bloodstream and crossing the blood-brain barrier, unlike their larger counterparts, which are confined to the respiratory tract. Furthermore, due to their small size, high surface area, and high reactivity, nanoparticles can incorporate trace elements into their structure and serve as carriers of these toxic metals, facilitating their transport through the air and into the human body. We used active air samplers to collect wildfire smoke from over 10 major wildfires in the Western U.S., separating them by size ranges from greater than 2.5 μm to less than 0.25 μm. Our findings indicated that, across various wildfires, the mass of particles increases as their size decreases, with the majority (over 65%) being smaller than 0.25 μm. Chemical analysis of the samples revealed that trace elements such as Fe, Cr, and Ti, with concentrations up to 1200 $ng/m^3$, are incorporated into ultrafine particles. Our findings show that the magnitude of airborne particulate matter health threats is significantly larger than previously assumed and must be considered to develop reliable strategies for mitigating respiratory exposure risks.