

***Microscopic Identification of Atmospheric Particulates***  
**Final Report**

This project involved collaboration between three Millersville University faculty in three different departments: Dr. Patricia Hill, chemistry; Dr. Richard Clark, meteorology; and Dr. Daniel Anna, Occupational Safety and Environmental Health (OSEH). In addition to the faculty, four Millersville students were active participants in the project. They were Lisa Winkler and Robert Callahan, chemistry, Jennifer Benvenuto, meteorology, and Daniel Nye, OSEH. The goal of the project was to utilize optical and polarized light microscopy to characterize and identify atmospheric particulate matter. Although the goal of complete atmospheric particle identification was not achieved, several significant outcomes were realized.

Atmospheric sampling was conducted initially in and around the Millersville area in order to develop a usable sampling protocol and to provide "practice samples" for students doing the microscopic analyses. During this phase of the project Dan Nye, under the guidance of Dr. Anna, developed and validated a new quantitative sampling protocol that allowed for the direct collection of particles onto the surface of a microscope slide. Initially the plan was to sample using a micropore filter however the new sampling method developed by Dan Nye eliminated the need to transfer and manipulate microscopic particles from a filter to a glass slide for viewing. This was particularly beneficial to the students who were learning to handle, observe and analyze the particles by optical and polarized light microscopy. As a result of his work, Dan was able to present his developed sampling protocol to others within his discipline.

Once the sampling protocol was in place, Dr. Clark and his students collected samples for this project at a site near Philadelphia where they were also carrying out tropospheric studies of particulate matter using highly sophisticated instrumentation. About 30 samples were collected and weighed. Of these 30 samples only two were analyzed by Lisa and Jennifer prior to their graduation. Jennifer was able to use NOAA trajectory analyses to estimate the source regions for the aerosols from which the samples derived. Using a set of reference standards of atmospheric particles purchased through this grant from McCrone Research Associates, a leader in microscopic particle analysis methods, Lisa was able to visually identify several of the species found in the samples, including fly ash and silicates (sand particles). Particles greater than 10 microns in diameter and larger were easiest to visualize and characterize. This was somewhat of a disappointment since environmentally significant "respirable particles" are those whose diameters are less than 10 microns. Characterization of these small particles would have required greater magnification than was available.

All four students who worked on the project have since graduated from Millersville and are either successfully employed in their field of study or are pursuing graduate degrees. This research project provided them with the valuable experience of working independently on a scientific study and presenting the results of their work in several venues and contributed in part to their success. Lisa Winkler presented a poster at the Spring 2002 National American Chemical Society meeting in Orlando, Florida. Jennifer, Lisa and Dan also presented the poster at the Millersville University Undergraduate Research Conference and displayed in during School of Science and

Mathematics Open House after the spring 2002 Honors Convocation. Dan Nye also presented the sampling protocol he developed for this project in a venue in his discipline.

During the following fall semester another chemistry major, Robert Callahan, began work on the project. His goal was to continue the work Lisa began trying to characterize and identify particulates in the 30 collected samples. He completed his initial training in using the microscope and fully characterizing known samples. However, he decided to change his major to biology in order to graduate sooner and he dropped the independent research credits for the project when he did this. This is one of the hazards of working with undergraduates. It takes time to train them in the necessary techniques, especially when working only a few hours per week, and then they often only want to work on a project for one semester before graduating.

This project was valuable for all faculty and students involved in the research. The collected air samples are still viable and awaiting further analysis by an interested chemistry major.

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