

Passage II

Substances in the atmosphere, such as Cu^{2+} , Zn^{2+} , Cl^- , and SO_4^{2-} ions, are carried down to Earth's surface by precipitation. This process is known as *wet deposition*. Cu^{2+} and Zn^{2+} ions are put into the atmosphere by high-temperature combustion processes. The presence of Cl^- and SO_4^{2-} ions in the atmosphere can be attributed to road-salt dust and electrical power generation, respectively.

Study 1

A rain gauge, placed on the roof of a 1-story building, at a specific urban site was used to collect precipitation over a 12-month period. At the same time each evening, the amount of precipitation in the rain gauge was recorded, after which the collected precipitation was emptied from the gauge and stored. (Assume no measurable evaporation occurred during any day.) Figure 1 shows the measured monthly precipitation in centimeters.

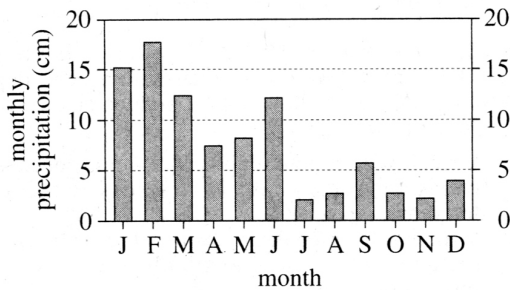


Figure 1

At the end of each month, all the samples collected during that month were mixed, and some of this combined sample was analyzed for the concentrations of Cu^{2+} and Zn^{2+} ions. Using these data, the monthly wet deposition of each substance, in micrograms (μg) per meter², was calculated (see Figure 2).

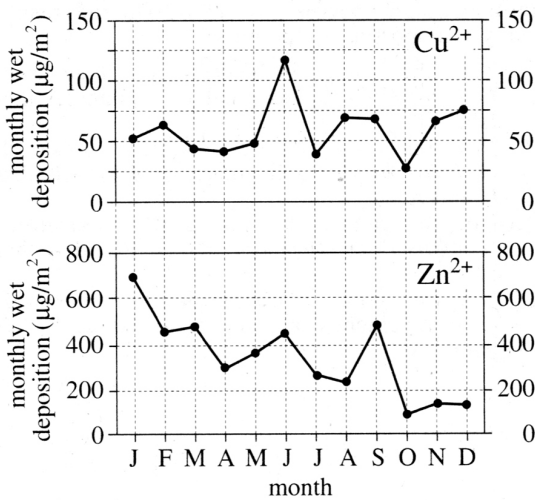


Figure 2

Study 2

Another portion of the combined sample for each month was analyzed for the concentrations of Cl^- and SO_4^{2-} ions. Using these data, the monthly wet deposition of each substance, in milliequivalents (meq) per m², was calculated (see Figure 3).

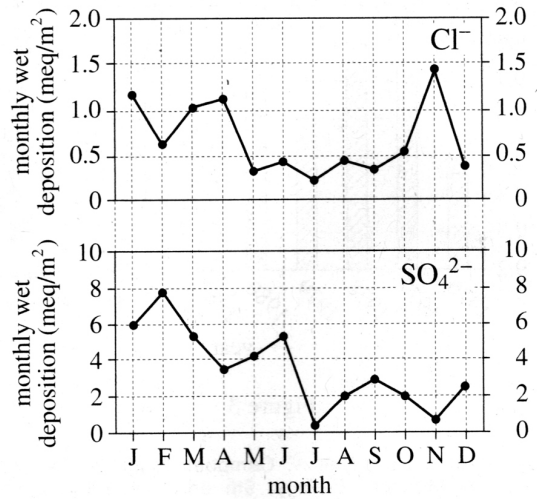


Figure 3

Study 3

The *annual* wet deposition of Cu^{2+} and of Zn^{2+} for the 12-month period, in $\mu\text{g}/\text{m}^2$, was calculated for the urban site (the source of the Cu^{2+} and Zn^{2+}) and also for Rural Sites 1 and 2, located 50 km and 100 km east, respectively, of the urban site (see Figure 4).

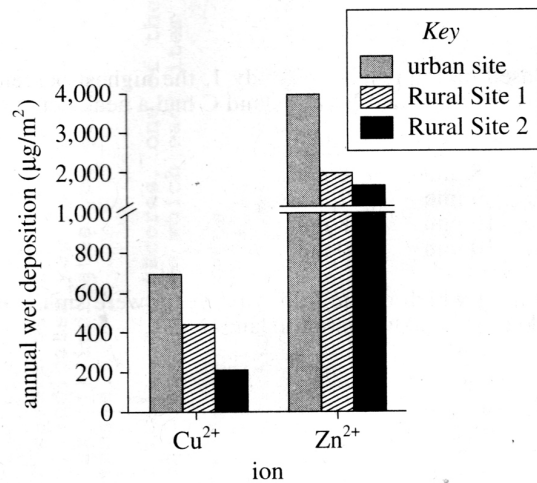


Figure 4

7. According to Figure 1, over the 12-month period, the monthly precipitation at the urban site was maximum in February and minimum in July. According to Figures 2 and 3, the wet deposition of which ion was also maximum in February and minimum in July?
- Cu^{2+}
 - Zn^{2+}
 - Cl^-
 - SO_4^{2-}
8. Based on the results of Study 1, the average monthly wet deposition for Cu^{2+} over the 12-month period was:
- less than $50 \mu\text{g}/\text{m}^2$.
 - between $50 \mu\text{g}/\text{m}^2$ and $75 \mu\text{g}/\text{m}^2$.
 - between $75 \mu\text{g}/\text{m}^2$ and $100 \mu\text{g}/\text{m}^2$.
 - greater than $100 \mu\text{g}/\text{m}^2$.
9. Is the statement "The values for Cl^- wet deposition were greater during the winter and early spring when road salt is typically applied" supported by the results of Study 2?
- Yes, because Cl^- wet deposition values were, on average, greater from November to April than they were from May to October.
 - Yes, because Cl^- wet deposition values were, on average, less from November to April than they were from May to October.
 - No, because Cl^- wet deposition values were, on average, greater from November to April than they were from May to October.
 - No, because Cl^- wet deposition values were, on average, less from November to April than they were from May to October.
10. Suppose there had been no precipitation during 1 entire month of the 12-month period. Based on the information provided, during that month there would have been:
- significant wet deposition of all 4 substances.
 - significant wet deposition of Cu^{2+} and Zn^{2+} , but no wet deposition of Cl^- and SO_4^{2-} .
 - no wet deposition of any of the 4 substances.
 - no wet deposition of Cu^{2+} and Zn^{2+} , but significant wet deposition of Cl^- and SO_4^{2-} .
11. According to Study 3, as distance from the urban site increased, the annual wet deposition:
- increased for both Cu^{2+} and Zn^{2+} .
 - increased for Cu^{2+} but decreased for Zn^{2+} .
 - decreased for both Cu^{2+} and Zn^{2+} .
 - remained the same for both Cu^{2+} and Zn^{2+} .
12. Which of the following variables was kept constant in Study 2?
- Site
 - Monthly rainfall
 - Wet deposition of Zn^{2+}
 - Wet deposition of Cl^-