

THE EFFECTS OF ACID AND PARTICULATE PRECIPITATION
ON PHYTOPLANKTON AND LAKE CHEMISTRY IN THE
SUDBURY REGION OF ONTARIO, CANADA

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ABSTRACT

The Sudbury basin, Ontario is the source of more than 60% of the free world's nickel and is also a major producer of copper, iron, cobalt and other metals. The sulfur dioxide and particulate discharge from the Sudbury smelters have been described and discussed in a number of publications and information will also be presented at the present conference.

A survey of some of the lakes in the Sudbury area (commencing 1958) revealed high sulfate concentration in lakes within 1.9 km of the smelters. Many of these lakes also had abnormally low pH values. In our own studies, a survey of the phytoplankton revealed severely depauperate populations and a low productivity. Bioassays with algal test species, on waters from lakes within 1.9 km of one of the smelters, indicated pH limitations to growth and survival, and severe but complicating metal problems, both from metals occurring in rocks and from particulate fallout. Algal isolates from these contaminated lakes proved to be metal tolerant (Stokes, Hutchinson and Krauter, 1973) and acid tolerant.

The use of increasingly tall stacks has extended the area of occurrence of acid rain. Other studies revealed acidification of lakes at least 24.8 km from the smelter, with changes in phytoplankton composition, even though overall phytoplankton biomass might not always be decreased. Destruction of the fish population of these latter lakes has already been described (Harvey and Beamish, 1973).

It is hypothesized that acid precipitation into lakes, especially shield lakes of low buffering capacity, would not only lower the pH and increase the solubility and availability of toxic heavy metals, but might also result in wide and rapid fluctuation in pH. Shifts in species population composition of algae such as we have observed would presumably also have effects on the primary consumers in the lakes. Possible consequences of acid rainfall on lake ecology in this and similar areas will be discussed. Possible consequences of acid rainfall on lake ecology in this and similar areas will be briefly discussed.