AAAS-Newcomb Cleveland Prize
To Be Awarded for a Report Published in *Science*

The AAAS-Newcomb Cleveland Prize, which previously honored research papers presented at AAAS annual meetings, is now awarded annually to the author of an outstanding paper published from September through August in the Reports section of *Science*. The second competition year under the new rules starts with the 2 September 1977 issue of *Science* and ends with that of 25 August 1978. The value of the prize is $5000; the winner also receives a bronze medal.

To be eligible, a paper must be a first-time publication of the author's own research. Reference to pertinent earlier work by the author may be included to give perspective.

Throughout the year, readers are invited to nominate papers appearing in the Reports section. Nominations must be typed, and the following information provided: the title of the paper, issue in which it was published, author's name, and a brief statement of justification for nomination. Nominations should be submitted to AAAS-Newcomb Cleveland Prize, AAAS, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Final selection will rest with a panel of distinguished scientists appointed by the Board of Directors.

The award will be presented at a session of the annual meeting at which the winner will be invited to present a paper reviewing the field related to the prizewinning research. The review paper will subsequently be published in *Science*. In cases of multiple authorship, the prize will be divided equally between or among the authors; the senior author will be invited to speak at the annual meeting.

Reports

Changing Atmospheric Fallout of Magnetic Particles Recorded in Recent Ombrotrophic Peat Sections

Abstract. *Magnetic measurements of ombrotrophic peat allow a reconstruction of changes in the past fallout of magnetic particles through the atmosphere. In recent peat profiles from three sites in Britain and Northern Ireland, a marked increase in saturated isothermal remanent magnetization of the peat is recorded in levels which can be shown to postdate the onset of the Industrial Revolution. Furthermore the spatial variation in contemporary isothermal remanent magnetization values is consistent with a recent industrial and urban origin for the bulk of the magnetic minerals present. Pre-Industrial Revolution values are between two and three orders of magnitude lower, suggesting that the natural cosmic and terrestrial sources previously cited for such material have been dominated in recent times by the products of human activity. Magnetic measurements provide a simple, rapid, and nondestructive method of monitoring and differentiating various types of particulate atmospheric fallout for both recent and preindustrial times.*

Doyle *et al.* (*1*) recorded large numbers of black magnetic spherules as a particulate component of the rain out into the eastern Gulf of Mexico. Following Parkin *et al.* (*2*), they suggested that the spherules are of industrial origin, probably formed as a by-product of processes involving coal and coke burning around the gulf. By contrast, some previous authors have concluded that such particles are predominantly of natural origin—for example, from cosmic sources as micrometeorites or terrestrial sources as a result of volcanic activity.

Ombrotrophic peat is a little-used source of evidence for past and present particulate fallout from the atmosphere. Once peat bogs forming in sufficiently humid and low-evaporation environments have begun to accumulate above the groundwater table, they become entirely dependent on direct precipitation for their moisture and on the atmosphere for any inorganic particulate mineral matter which may become incorporated in the successive layers of accumulation. They thus preserve a record of atmospheric particulate input to the land surface.

The changing concentration of magnetic minerals in peat, as in sediments, can be estimated simply and rapidly by measuring the magnetic susceptibility (χ) or the saturated isothermal remanent magnetization (IRM) of the material. Thompson *et al.* (*3*) have shown that where the ferrimagnetic minerals present are relatively homogeneous, these two properties are proportional. Methods of measurement and units used are summarized in Oldfield *et al.* (*4*). In an applied field of 10^4 oersteds, magnetic particle concentrations as low as 1 part per million acquire an IRM well above the noise level of our equipment; consequently, the evidence summarized here is expressed as IRM values.

Figure 1 shows the IRM values of recent peat profiles from three ombrotrophic bogs. Holland Moss on the eastern fringe of Liverpool lies 20 km downwind from the center of the major industrial, residential, and commercial conurbation of Merseyside (population, 1.5 million). Bolton Fell Moss, which has provided two profiles from adjacent pool- and hummock-dominated microenvironments in the recent regeneration peat (*5*), lies in relatively open country 15 km northwest of Carlisle, a much smaller industrial center with about 100,000 inhabitants at present. Lough Fea bog, in a remote area of County Tyrone in Northern Ireland, at an altitude of about 200 m, totally lacks any major source of industrial atmospheric output to windward and is some 10 km distant from even minor centers such as Cookstown (population, 5000). Near-surface IRM values are consistent with a deduced industrial and urban origin for the material responsible for the magnetic properties measured at each site.

At each site, independent evidence exists for the age of the recent peats. At Lough Fea bog, characteristic pollen-analytical changes recording a dramatic transformation of the local landscape in the late 18th and early to middle 19th century are clearly recorded in the peat

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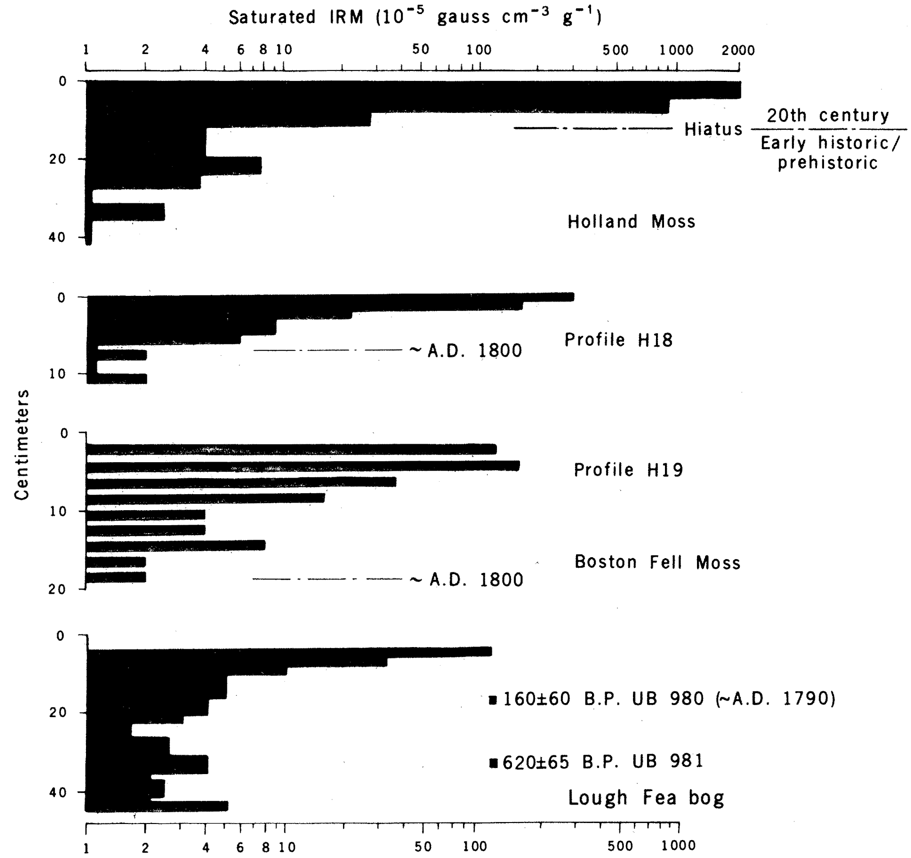

Fig. 1. Variations in saturated isothermal remanent magnetization (*IRM*) with depth in near-surface profiles from three ombrotrophic peat bogs in the United Kingdom. All samples were measured after saturation in an applied field of 10^4 oersteds.

at 15 to 20 cm. The radiocarbon date of 160 ± 60 years before present (B.P.) is for peat between 16 and 18 cm. The increase in IRM values clearly postdates these levels, indicating a period during and after the Industrial Revolution for the increase in magnetic content of the peat.

At Bolton Fell Moss, pollen analysis of both profiles also shows land-use changes characteristic of the late 18th and early 19th century in northwest England, including the virtual end of hemp cultivation (*6*) and the afforestation of local parkland with pines and exotic conifers. In profile H18 from a large hummock, the changes take place at 6 to 7 cm, just below the increase in IRM. In profile H19 from an adjacent, deep, infilled pool, the change occurs as low as 18 cm, 10 cm below the first major increase in IRM. A lower level in the profile, radiocarbon-dated to 505 ± 35 years B.P., lies 22 cm below this. In both profiles, the results are consistent with a 19th-century increase in magnetism and point to a recent anthropogenic source for the bulk of the magnetic particles present in the peat.

Holland Moss is a rather special case in that the surface of the bog has been trimmed down to the present level by an unknown amount of peat cutting for horticultural use in the present century. There is thus a hiatus at the top with very recent highly magnetic material overlying very weakly magnetic peat of prehistoric or early historic age. As with the two previous sites, however, the more magnetic peat is seen to be a very recent phenomenon resulting from human activities.

In summary, the evidence outlined here appears to be conclusively in support of the suggestion of Doyle *et al.* (*1*) that the dominant sources of magnetic particles in the atmosphere at present are industrial and urban. Magnetic measurements in recent peat profiles show that, at the sites studied, the influx of these minerals has increased by two to three orders of magnitude since the beginning of the Industrial Revolution and the first widespread use of fossil fuel for industrial and domestic purposes. Ongoing studies, designed to characterize more fully the magnetic particles responsible for both the recent maximum and the smaller pre-Industrial Revolution peaks in IRM and to date the magnetic variations recorded by ^{14}C and ^{210}Pb analysis, should increase our knowledge of the nature of the long-term influx of magnetic material and the precise age and origins of the variations recorded. Results to date show that rapid, nondestructive magnetic measurements of ombrotrophic peat provide a means both of estimating spatial and temporal variations in post-Industrial Revolution particulate atmospheric fallout and of characterizing and differentiating pre-19th century fallout.

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Aluminum in Seawater: Control by Biological Activity

Abstract. *The distribution and concentration of dissolved aluminum in a vertical hydrographic profile in the Mediterranean Sea near Corsica are controlled by biological activity. The concentrations of dissolved silica and aluminum covary in the profile and exhibit minima coincident with the seasonal thermocline, a nitrate minimum, and an oxygen maximum. These observations support the hypothesis that the silicon and aluminum cycles in the oceans are linked through the activity of diatoms.*

The factors that control the concentration and distribution of dissolved aluminum in seawater are poorly known. Sillén (*1*), in his model of the controls of the chemical composition of seawater, proposed that aluminum is regulated by thermodynamic equilibria between seawater and various aluminosilicate minerals found in marine sediments. Various authors (*2*) have discussed, extended,

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