Letters

Mill Tailings: Reclamation Costs

Mark Crawford's article "Mill tailings: A $4-billion problem" (News and Comment, 9 Aug., p. 537) incorrectly states that "milling companies, many of which are owned by major corporations like . . . Exxon . . . , want to shift 55 percent of the reclamation costs to the electric utility industry and another 30 percent to the federal government."

We are not a supporter of such legislation and have stated so when asked. I regret that we were not called to clarify our stance. The two uranium properties we are reclaiming are being done so at our expense and in compliance with applicable state and federal standards.

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Hydroelectricity: Environmental and Social Effects

The editorial, "Electric power from the north" by Philip H. Abelson (28 June, p. 1487) said little about the adverse environmental and social effects of northern hydroelectric development. Robert Carson's letter (30 Aug., p. 815) lists several environmental considerations related to dam construction (including flood control and recreation), but does not discuss other environmental matters of importance in the subarctic.

One kind of environmental disaster that could result from northern hydroelectric projects occurred when 2200 caribou drowned while attempting to ford the Caniapiscau River (*1*). Two weeks earlier, Hydro-Quebec had opened a spillway, and water from a reservoir had discharged into the river.

But the more important social consequences of northern development were not mentioned by Abelson, or by Carson. During the James Bay project, much of the homeland of 9000 Cree and Inuit people was flooded and therefore taken from them. These people were not involved in any of the planning of the project and were firmly opposed to it (*2*). I trust that Americans, when they buy cheap and "clean" power from the North, will bear this in mind.

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References and Notes

1. Toronto *Globe and Mail*, 4 October 1984, p. 1.
2. B. Richardson, *Strangers Devour the Land* (Macmillan, Toronto, 1975).

Exporting Education

In Gina Kolata's article "Americans scarce in math grad schools" (News and Comment, 15 Nov., p. 787), it seems to be taken for granted that the substantial number of foreign graduate students in Ph.D. programs in American universities represents a *problem*. It seems that the implicit explanation for this phenomena is that there are insufficient incentives for American students to pursue Ph.D.'s and that the American labor market for mathematicians is being filled with Japanese, Indian, and Mexican graduate students; the jobs in mathematics are analogous to "stoop labor" jobs, taken by legal or illegal immigrants. There may be some truth in this, and if so there may be a "problem," the solution to which is to make mathematics a better paid profession, for example.

But I strongly suspect that a quite different explanation is at least as likely, and that is that American universities are the world's lowest-cost providers of advanced training in the mathematical sciences. And just as we have turned to the Japanese to supply us with video cassette recorders, because they provide the best product for the lowest cost, so the Japanese and others have turned to us to supply them with the service of training mathematicians. The fact that half of the students return to their homes bears this out. We should regard this as an opportunity, not a problem! Why shouldn't the United States become (if it isn't already) the leading exporter of the service of education in the world? Let the Japanese make VCR's and the Koreans make steel; we will sell education. We need to be careful with pricing, of course, so that we don't sell for a price lower than our costs. But the benefits of exporting educational services, it seems, are both financial and political.

Perhaps the headline for the article should have been, "Foreign students eager to purchase American math training."

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The Space Station

The article by K. J. Frost and F. B. McDonald (21 Dec. 1984, p. 1381) attempting to justify a permanent manned space station on scientific grounds deserves detailed comment because it presents a weak case for such a facility.

One major proposed use of a space station is for in-orbit assembly, refurbishment, and repair of astronomical observatories such as the Space Telescope, the Gamma-Ray Observatory, and some proposed but not yet authorized facilities, such as the Advanced X-Ray Astronomy Facility (AXAF), the Space Infrared Telescope Facility (SIRTF), and other observatories. These facilities can be serviced by a space station only if their orbits intersect that of the space station and preferably if their orbits are nearly identical. However, identical orbits may not be scientifically optimal or even desirable. For example, the currently operating x-ray satellite, EXOSAT, has a very eccentric orbit to maximize its dwell time on specific sources. Other eccentric orbits, each in its own optimal plane, may be desirable for AXAF and SIRTF. Furthermore, observatories such as the Space Telescope are designed for infrequent repair and refurbishment missions—about once every 5 years—which can be accomplished by a much less costly shuttle mission. Of the various space observatories listed in table 1 of the article by Frost and McDonald, only the large deployable reflector appears to have the dimensions that might require space station assembly rather than a shuttle launch and assembly.

The suggestion that the space station be used for future planetary probe assembly, fueling, and inspection is hard to