As a researcher concerned with the appropriate use of oral tradition, I was most interested in the papers by Helena Laraque and Norman Hallendy. Laraque's contribution demonstrates the profound change that has occurred during one Chipewyan woman's lifetime. Her use of verbatim quotations allows the reader to fully appreciate the woman's knowledge and use of local resources. Hallendy collected some valuable information from the Inuit elders of Cape Dorset in a manner that was sensitive to the people who shared their stories. However, his data presentation contradicts his collection method. Although Hallendy states that he did not use a tape recorder, he presents his information in quotations. I agree that listening is a very important field technique; however, listening and understanding do not give a researcher the right to use quotations as if the information were presented verbatim. This is a technical error, but an important consideration. If knowledge that is transmitted orally is to be respected to the same degree as written knowledge, it must be treated with the same rules and regulations. In spite of this technical error, Hallendy successfully conveys the depth and complexity of the Inuit memory culture.

Perhaps the most important aspect of the Prince of Wales Northern Heritage Centre Occasional Papers series is its success in bringing together various methods of understanding human history. The papers in this volume are clearly written and well illustrated and will appeal to lay persons, students and professionals. Also important is its potential usefulness as a reader for high school and introductory university courses dealing with North American native peoples. In my opinion, it is a valuable contribution to anthropological and historical literature, as is the latest issue of this series: *Thule Pioneers*, Occasional Papers no. 2, edited by E. Beilawski, Carolyn Kobelka and Robert R. Janes.

Allice Legat
Northern Heritage Society
Box 475
Yellowknife, Northwest Territories, Canada
X1A 2N4

NUCLEAR WINTER AND ASSOCIATED EFFECTS — A CANADIAN APPRAISAL OF THE ENVIRONMENTAL IMPACT OF A NUCLEAR WAR. Edited by ANDREW FORESTER. Ottawa: The Royal Society of Canada, 1985. 382 p. + illus. Softbound. Cdn$15.

This report of the Royal Society's Committee on the Environmental Consequences of Nuclear War was published in January 1985 and is a thought-provoking contribution to the growing mass of literature on this subject. The text of the main report is 52 pages long and is largely a review of a 250-page supplementary section, which includes 16 papers written by specialists in various areas related to the subject. The inclusion of these background papers adds greatly to the impact of the report. Unfortunately, however, not many people are likely to have the inclination, time and background needed to read all the material and study it. Nevertheless, it is an important document and deserves a lot of attention. The committee is to be commended for bringing these various contributions together and for providing a more integrated overview of the possible effects of a nuclear war, resulting in nuclear winter.

The purpose of this review is to provide the essence of the report in a brief, comprehensive form so that readers will understand what is likely to happen if a nuclear winter were to develop. It is hoped that this will lead to more determined steps to prevent a nuclear war from occurring.

The study, requested by the Minister of the Environment, the Honourable Charles Caccia, was to consider "the environmental and ecological consequences of nuclear war." In a covering letter to the president of the Royal Society, the chairman of the committee, F.K. Hare, noted that "nuclear winter is a very contentious issue defying analysis by the usual methods of scientific and scholarly research." He stated further that although the Society's usual norms may have been exceeded, the committee felt that the Government of Canada should be made aware of the "macabre predictions being made by responsible scientists."

The Effects on Canada of a U.S.A.-U.S.S.R. Nuclear War: Two general situations need to be considered in the event of a nuclear war between the United States and the Soviet Union. One situation would involve only targets in the United States and the Soviet Union, while the second would involve Canadian targets as well.

In the situation where Canadian targets would not be attacked, the possibility of Canadian cities suffering in the aftermath of a major nuclear confrontation with an expenditure of, for example, 5000 megatonnes of explosive power by the two superpowers is still great. Turco and Ackerman, who contributed to the report, pointed out that the major cities, Toronto, Montreal, Ottawa, Quebec City and Halifax, with one-third of the population of Canada, lie downwind from the strategic U.S. missile bases at Malmstrom, Montana; Minot and Grand Forks, North Dakota; and Ellsworth, South Dakota, in addition to the heavily industrialized Midwest, which also would be targetted. Additionally, the cities of western Canada — Victoria, Vancouver, Calgary, Edmonton, Saskatoon, Regina and Winnipeg — with approximately 15 percent of Canada's population, could be expected to receive intermediate and long-range fallout as a result of being downwind from strategic naval bases near Seattle, Washington. Those living in Vancouver and Victoria would be subjected to the more dangerous early fallout as well.

Turco and Ackerman, both members of the TAPPS group, which wrote one of the early articles on nuclear winter, pointed out that Canada, as an active member of the NATO alliance, would be committed to the defence of its allies if a nuclear war were to break out between the United States and the Soviet Union. Canada could expect "to receive prodigious demands for assistance from her allies and neighbors. Food and supplies would be in great demand. Millions might seek refuge in the cities of Canada, if they had been spared bombing. Governments would request immediate aid in transport, manufacturing and communication. As nuclear winter settled over the world, increasing chaos and civil disobedience could be expected. Canada would have the difficult choice of withdrawing such assistance to ensure, as best she could, the survival of those at home, or extending a helping hand to outsiders with the attendant danger of being overwhelmed." This scenario raises the question of whether the Canadian government and the people of Canada should be prepared to provide for literally millions of extra people should such a confrontation occur.

No Canadian could expect to be free of the effects of radiation and nuclear winter even if Canadian targets were not attacked and they did not live in the paths of the nuclear clouds that would be travelling downwind from targets in the United States. In a matter of several days after the attack, clouds containing radioactive dust, soot and smoke from the Soviet Union would be carried via the upper atmosphere around the northern latitudes covering much of Canada and plunging the country into the darkness of nuclear winter.

As hideous as this scenario might seem, it is likely that several million Canadians would survive the initial attack and, depending upon the temperature, food supplies, availability of medical aid, fuel, clothing and shelters, would be faced with the harsh realities of this greatly changed environment. Many would suffer from radiation sickness, their immune systems would be affected, so that diseases such as influenza, pneumonia, cholera, tuberculosis and dysentry could break out. Diseases would spread rapidly because those who survived the attack would probably have to live in crowded, cramped quarters while waiting for the atmosphere to clear so that it would be safe outside again. In addition, water supplies would likely be polluted, causing other forms of infection.

To most people such a situation is unthinkable, so nothing much is being done to prepare the population for such an eventuality.

Canadian Targets Likely to Be Attacked: Fairly convincing arguments can be advanced suggesting that Canada, as a member of NATO and NORAD, would also be attacked and several target areas devastated if a nuclear war were to occur. The objective would be to destroy Canada's ability to support its allies.

Military targets, such as major airfields where long-range bombers can land and refuel, major ports on the east and west coasts, centres that

control the flow of energy through pipelines and electrical grids, the major marshalling yards of the railway systems, the locks of the St. Lawrence Seaway, as well as certain communications, command and control centres would likely be attacked. In addition to receiving fallout from many targets in the United States, many Canadian cities might be attacked to destroy them deliberately or because they are near military or industrial targets, such as oil refineries, oil and gas pipeline control centres and petrochemical plants. Turco and Ackerman suggested that the Soviet Union, with approximately 9000 strategic warheads available for use, would likely designate 100-300 of them, with a total of about 100 megatonnes of explosive power, for attacks on Canadian targets. Such action, according to these authors, would "ensure that the Canadian Government, people, industry, and agriculture could not easily provide supplies and safe haven for the Allies."

Nuclear Winter Effects on Agriculture and Forests: Any cities that were targets of such a nuclear attack would become major sources of smoke, toxic gases and soot. The intense heat of the nuclear fireball and of burning buildings would carry black, carbonaceous material up through the troposphere into the stratosphere, where it could remain for months, reducing the amount of sunlight reaching the earth's surface and causing cooling of the lower atmosphere. According to Herbert Grover, another contributor to the report, the effects of radiation, the reduced sunlight and the reduction of the average temperature during the summer by as little as 1-4°C (one-tenth of some predicted values) would have a devastating effect on the growth and maturation of agricultural crops, thereby affecting food supplies. Starvation of millions of people would likely occur if they had not already been killed by more direct effects.

Nuclear explosions might be expected to start fires that could burn up to 500 000 km^2 of forest. According to Grover, depending upon the season in which the nuclear attack occurred, there would be blow-down of trees in the vicinity of a blast as well as extensive fire damage. "Not only would dead trees increase the fuel load in certain areas, but thinning of the canopy where dieback was incomplete would allow the forest floor to dry, providing an ideal fuel bed for catastrophic fires." These fires would contribute extensively to the load of smoke, soot and toxic gases in the atmosphere, adding to the intensity of the nuclear winter. Dry muskeg bogs, once ignited, might smolder for weeks. The report seems to have missed the possibility that exposed bitumen in open pit mines at the Suncor and Syncrude tar sands plants near Fort McMurray, Alberta, could also be set ablaze, creating a very heavy pall of smoke contributing to the darkness and cold extending over the country.

Medical Aspects: According to the report just what would happen in the atmosphere is a subject of considerable debate requiring further research to be able to predict what might happen in the event of a nuclear war. With the use of large nuclear warheads with explosive powers greater than 0.3 megatonnes, the fireball is likely to have enough energy to rise into the lower stratosphere. Because soot and carbonaceous materials would be produced from organic matter involved in blasts on certain targets, oxygen in the area of the blast would be consumed. With a deficiency of oxygen and high temperatures, considerable nitric oxide and carbon monoxide would be produced. The nitric oxide is known to react rapidly with the ozone in the stratosphere, so there is justifiable concern as to what would happen to the ozone layer. If it were "thinned" significantly, ultra violet rays from the sun could be expected to pass through the stratosphere and on through the troposphere, creating an additional hazard for people, who might be blinded or get skin cancer if they have survived the nuclear winter and did not have suitable protection. There is the additional possibility of more ozone forming in the troposphere from reactions similar to those in photochemical smog. This ozone could conceivably absorb the ultra violet rays from the sun passing through the thinned upper ozone layer and decrease or eliminate that particular hazard. Further research is needed to substantiate what might occur.

The Physicians for Social Responsibility have gone on record as saying that medical services simply could not cope with a nuclear disaster. Even an attack on a single city could not be handled because of the thousands of victims anticipated and the lack of facilities, personnel and supplies to treat the many people suffering from burns, radiation and other effects of the blast.

While this stand no doubt fairly accurately portrays the conditions that would likely exist in the bombed major cities and downwind from them, it does not apply to the more northerly parts of Canada, where there are few targets and yet, perhaps, one-quarter of the population lives. It would seem reasonable for the physicians to consider these regions of Canada in terms of what they might be able to do to relieve the suffering if people were properly trained, supplies were available and plans were in place to survive a nuclear winter.

Effects on the Canadian Arctic Region: The effects of a nuclear winter on the northern arctic regions of Canada would probably not be nearly as serious as they would be in the more southerly regions of Canada. In the Arctic, above the tree line and where there are few settlements, there would be relatively little fuel to burn, so few secondary effects would be expected even if certain military targets were bombed. Nuclear winter possibly might result from debris in the upper atmosphere being carried from the Soviet Union eastward over Canada at the northerly latitudes. Little, however, is known as to how smoke, pyrotoxins and radioactivity discharged into the atmosphere in the mid-latitudes would be spread or dispersed into the polar regions and deposited.

One group (E.F. Roots *et al.*) speculated that biological life in these northerly regions would be relatively less susceptible to change in the environment caused by nuclear winter than life in the mid-latitudes. Because of the long arctic winters, life in that region is already adjusted to periods with little or no sunshine and hence periods with little or no photosynthesis as well as sudden changes in the weather. Part of the polar life pattern includes large-scale die-offs of populations in some regions as well as local extinctions. When life cannot be otherwise sustained, the ecosystem survives by reverting to prolonged dormancy. When conditions become favorable again, there is rapid colonization of barren areas. From such considerations, it would appear reasonable to expect that arctic ecosystems would suffer little serious damage from the environmental effects of nuclear winter. However, should nuclear winter occur during the calving season, herds of migratory caribou might be exterminated and birds that migrate north to breed might disappear. If the rivers in the region froze during critical early summer runoff, the coastal spawning grounds of open water near the stream mouths might be devastated through a lack of oxygen or food supplies.

The effects of fallout of radioactivity on the arctic ecosystems are difficult to estimate. However, in view of the short food chains and the low rates of exchange of energy, it is speculated that radionuclides would rapidly concentrate in higher trophic levels and thereby cause large mammals and humans to be predisposed to disease as well as to have a weakened ability to resist starvation.

To a considerable degree, Canada's northern areas already exist with lower levels of biological productivity than those in the south, so it is possible that they might cope with nuclear winter more effectively. It is possible that these areas might serve as a refuge for people while awaiting recovery of the more severely damaged areas to the south in Canada.

The population of Canada north of latitude 60°N is approximately 75 000. It is unlikely that the small settlements of people scattered across this large area would be attacked in the event of a nuclear war. It is possible, however, that communication, command and control centres, as well as radar installations, airports and pipelines carrying oil and gas, might be attacked with small, accurate nuclear warheads.

The resulting possible disruptions in communications, fuel availability and food supplies might have a devastating effect on the population initially. However, the people of these areas are much less vulnerable to disruption and breakdown than the people living farther south. It is thought that they could cope much better with devastation, shortages of food and the necessity to live off the land than the rest of Canadian society. The people of the northern regions who have learned to survive by hunting are considered to know much about their philosophy of

survival, social stability and the value systems of individuals and groups that could be valuable to other Canadians in the event of a nuclear war.

Strategic Considerations: The committee concluded that "although modelling results must be interpreted with care, a prima facia case has been made that a nuclear winter will indeed follow a wide range of attacks." On the other hand, the Department of National Defence concluded that if the scientific findings of the nuclear winter studies are accepted, "strategic policy will not be affected in any profound manner." It would seem that nuclear winter is being treated as an unproven hypothesis. However, the military and strategic planners should be reminded that at one time the concepts of both the atomic and hydrogen bombs were unproven hypotheses. Fortunately, civilization was not at stake when they were tested. Hopefully, it will not take a nuclear war to convince people that nuclear winter will follow!

The paper from the department argues a case for deterrence, claiming it to be "the safest system within our present reach." The concept of deterrence is also a hypothesis, but one that the military continues to cling to relentlessly. Is deterrence at the present level of stockpiles now held really the safest system if by any far-out chance the weapons held by the nuclear powers were to be put into action by design, by an accident, by a bad communication or by some perhaps unknown factor, as remote as it may be? Surely deterrence at the level proposed by Carl Sagan, which would not create a climatic catastrophe, is a worthwhile intermediate goal that all politicians, strategists, military scientists, technologists and people in general around the world should be actively seeking if they are to be considered responsible stewards of this planet's environment?

The attitude on the part of the military that deterrence equates with security is flawed. The world today is far less secure than it was just prior to the nuclear arms race. Deterrence existed years ago when each superpower had enough ICBMs to wipe out a major city on the other side. Over the years, military planners and strategists have advised governments on both sides to increase their forces to the point that if they were used they would destroy civilization as we know it, partly as a result of nuclear winter.

Sagan has argued that in view of a possible climatic catastrophe, questions need to be raised about national and international security and hence the need for reducing world arsenals of nuclear weapons below the threshold level so this could not happen.

Conclusion: The Government of Canada and the Royal Society of Canada are to be commended for funding and producing this report on nuclear winter. It is an important document that should be read by thoughtful Canadians, especially scientists, politicians, the military planners and teachers. It is important that the report be followed up by research on some physical and biological aspects of nuclear winter but, more so, that a report on the social consequences of a nuclear war be undertaken. Above all, it is important for the Government of Canada to continue its efforts to avoid nuclear war by every possible means and by efforts in concert with other middle powers to put pressure on the nuclear powers to reduce their nuclear arms stockpiles so that nuclear winter can never happen!

Eric L. Tollefson
Department of Chemical and Petroleum Engineering
University of Calgary
Calgary, Alberta, Canada
T2N 1N4

DAS GRÄBERFELD DER HUNNO-SARMATISCHEN ZEIT VON KOKËL', TUVA, SÜD-SIBIRIEN. By ROMAN KENK, based on site report by S.I. VAJNŠTEJN and V.P. D'JAKONOVA. Kommission fuer Allgemeine und Vergleichende Archaeologie des Deutschen Archaeologischen Instituts Bonn, AVA-Materialien, vol. 25. München: Verlag C.H. Beck, 1984. 202 p., 62 illus., 2 tables, no index. In German. Softbound.

More than 20 years ago two noted Soviet scholars, S.I. Vainshtain and V.P. Diakonova (Trudy . . . ,1966, 1970), published extensive field reports on a large burial field at Kokel' in Tuva, U.S.S.R., with burial mounds or separate graves of Scythian, Hunno-Sarmatian, Old Turcic and recent (19th-century) origin. The Hunno-Sarmatian burials predominated. The field report was to be followed by analytical treatment of data by the excavators, but, as Roman Kenk tells us in the foreword, to date it has not been published. In view of the significance of the find, Kenk undertook to analyze the published data, focusing exclusively on the Hunno-Sarmatian or Shurmak burials. They are represented by four Great Burial Mounds (367 skeletons), 18 small burial mounds (76 skeletons), individual mounds of various forms including cenotaphs (28 skeletons) and 3 flat graves (4 skeletons). This he has done in an admirably systematic fashion. From the results obtained, the author inferred aspects of the cultural system of the people who used the Kokel' burial ground, according to Kenk, in the course of ca. 300 years, between 200 B.C. and 100 A.D. Their ethnic identity is left open, though, on the basis of physical anthropological and artifactual evidence, they are believed not to have been Huns.

The books falls into two parts: analysis of the published data (p. 9-89) and interpretation (p. 90-107). The rest (p. 108-202) is devoted to documentation: illustrations and tables.

Kenk reorganized the artifactual data (originally published by artifact categories) into a list that shows the artifactual inventory of individual burials within each of the burial mounds (Table 2, p. 166-185). He also compiled a table with the following information for each burial: the number of persons interred (single or multiple); age and sex of the skeletons; grave dimensions, with grave depth given in a separate column; orientation of the mound, grave pits and skeletons in terms of compass directions; and animal and plant remains found with the body or in the grave.

In the Introduction, Kenk summarizes the basic data about the Kokel' burial field and states that the main period of use falls into the period defined by L.R. Kyzlasov as Shurmak Culture, of the Hunno-Shurmak (Hunno-Sarmatian) Epoch, dating from the 2nd century B.C. to the 5th century A.D. There are both older (200 B.C.-200 A.D.) and younger (200-500 A.D.) phases (Kyzlasov, 1979, after Kenk, *Drevniaia Tuva*). Kenk also points out that the Shurmak Culture finds from Kokel' are clearly distinct from Scythian finds there, as well as from other Scythian sites in the region (the Uyuk Culture). These finds are also different from the contemporaneous Tashtyk Culture of the Minusinsk Depression, although certain artifactual features permit Kenk to infer communication, interaction or exchange between the Shurmak Culture bearers of Kokel' and the Tashtykians of the Upper Enisei valley. Kenk suggests that the use of Kokel' burial ground by the Shurmak Culture bearers was relatively short, because the artifactual inventory (though separable into older and younger) does not demonstrate any significant changes over time.

In the following chapters (unnumbered) Kenk discusses the form and structural features of graves; modes of burial (extended prone with bodies placed directly on ground, tree branches, boards, or within a wooden construction, in log coffins, and, in exceptional cases, in wood or stone coffins, or sometimes surrounded by stones [p. 25:Fig. 13]). Occasionally, the wooden burial structure had a compartment for supplies (p. 25:Fig. 10). Variations in body arrangement also occur, although they are rare. These include burials flexed on the back or side, extended burials on the side, separation of the body and skull with the skull being placed in a separate compartment, skeletons without skulls and dismembered skeletons.

Grave inventories are discussed (p. 35-58) in meticulous detail. Throughout, Kenk refers to sex and age of the individual and is able to establish the grave goods complexes not only by gender, but also by age. He is able to demonstrate that the grave inventories for men show significant differences by age cohort (adult, mature and senile, the age cohort schema presumably according to the one established by Martin Saller, 1957). Careful attention not only to the occurrence of animal and plant remains, but specifically to their disposition within the graves and in relation to the body, permits him to conclude (in the second part