to produce the pollen counts found in the lowest levels of the profile[9]. Pollen Groups 4 and 5 also make a significant showing, but since these groups are composed of a mixture of species found in swamp and secondary forest and of ubiquitous species, their indicator value is unclear[5-11].

At 9.35 m, inorganic matter content and charcoal decrease. This change is echoed in the pollen diagram by increases in *Myrica*, Myrtaceae, *Schefflera* and ferns, all of which are commonly found in swamp forest[5,7,10], as well *Macaranga* and *Olea*, which are common taxa of secondary or scrub forest[5-7]. *Alchornea* rises to reach its maximum level in the profile at 8.75 m. Pollen Groups 4 and 5 increase but their indicator value is unclear. Gramineae show a significant decrease. These factors suggest that wetter conditions allowed swamp forest to develop on the valley floor and forest on the slopes.

At 8.25 m, the inorganic matter content and charcoal again increase, the swamp forest species decline and Gramineae increase, indicating a return to drier conditions. This change occurs at ~3,700 years BP, which is widely regarded as marking a major change to drier conditions in East Africa[4,12].

The dramatic rise in swamp forest species at 7.5 m (~3,400 yrs BP) indicates a return to wetter conditions.

It is clear from these data that the early part of this pollen diagram reflects the influence of climatic change and not anthropogenic influence as the authors suggest. Further stable isotope analyses from this core should prove informative.

R. ALAN PERROTT

Tropical Palaeoenvironments Research Group, School of Geography, University of Oxford, Oxford OX1 3TB, UK

1. Hamilton, A., Taylor, D. & Vogel, J. C. *Nature* **320**, 164–167 (1986).
2. Winter, K., Troughton, J. H. & Card, K. A. *Oecologia* (Berlin) **25**, 115–123 (1976).
3. Perrott, R. A. *7th Biennial Conf. AMQUA* **153**, (University of Washington, Seattle, 1982).
4. Hamilton, A. C. *Environmental History of East Africa* (Academic, London, 1982).
5. Hamilton, A. *Uganda Forest Trees* (Makerere, Uganda, 1981).
6. White, F. *The Vegetation of Africa* (UNESCO, Paris, 1983).
7. Lind, E. M. & Morrison, M. E. S. *East African Vegetation* (Longman, London, 1974).
8. Hamilton, A. thesis, Makerere University, Uganda (1970).
9. Hamilton, A. *Palaeocol. Afr.* **7**, 45–149 (1972).
10. Dale, I. R. & Greenway, P. J. *Kenya Trees and Shrubs* (Buchanan's Kenya Estates Limited, Nairobi, 1961).
11. Agnew, A. D. Q. *Upland Kenya Wild Flowers* (Oxford U. Press, 1974).
12. Perrott, R. A. *Palaeocol. Afr.* **14**, 77–83 (1982).

TAYLOR HAMILTON REPLY—Perrott's criticism of our interpretation of the work from Ahakagyezi[1] rests on the assertion that it was two early dry phases which were responsible for the changes in vegetation, not the destructive influence of man.

These 'more arid' periods are marked by abundant grass pollen and have given $\delta^{13}C$ values for two sediment samples of −18.2 and −15.9%, contrasting with $\delta^{13}C$ values of −27.0, −26.0 and −26.9% for three samples higher up the core. Perrott assumes that C_4 plants, in particular savanna grasses, are responsible for the less negative $\delta^{13}C$ values. A swamp surface, like that at Ahakagyezi (which has one of the highest rates of peat accumulation known from Africa[2]), is hardly a suitable substrate for savanna type grasses; it cannot be compared to seasonally inundated floodplains where C_4 grasses can grow[3] and which have inorganic soils[4]. Measurements of $\delta^{13}C$ are available for some C_4 grasses: *Andropogon amethystinus* (−10.9%), *Pennisetum clandestinum* (−11.8%), *Sporobolus africanus* (−11.0 *to* −11.3%) *and Themeda triandra* (−11.4%) (D. Harkness, personal communication); all of which are more positive than our stable isotope readings said to represent savanna grasses.

The $\delta^{13}C$ values from Ahakagyezi can be compared with those from core samples from Kamiranzovu Swamp, Rwanda[5]. The upper three samples are from sediment rich in fossil wood and yield $\delta^{13}C$ values close to those obtained from similar sediments from Kamiranzovu (−26.9, −27.0%). The lower two samples contain abundant herbaceous fossils and have similar $\delta^{13}C$ values to those of sediments rich in herbaceous fossils and Cuperaceae pollen at Kamiranzovu (=16.6, −17.9%), Sedge pollen is one of the most common types in the lower samples from Ajakagyezi, but it is less frequent than at Kamitanzovu and we envisage a wetter environment. Under such moist conditions the algal contribution to the sediment is likely to have been great. Typically planktonic algae have $\delta^{13}C$ values between −12.0 and −23.0% (ref. 6).

Aridification, begining ~3,700 BP, has been reported from many sites in Africa[5]. Levels of inorganic material appear to be generally less since 3,700 BP than they are before it, the latter being a period marked by a more moist climate. Inorganic inwash as a consequence of forest clearance has been previously detected at one other site in southwest Uganda[7] and is well known in other parts of the world. Sedimentation in East African basins is complex[2]; we contend that at Ahakagyezi sediments rich in inorganic material have accumulated when the climate was wetter or following human disturbance.

The absence of pollen definitely attributable to cultivated plants is a feature common to most pollen diagrams from tropical Africa[5,8]. Many possible food crops at Ahakagyezi are either poor pollen producers (for example, legumes, root crops) or have pollen indistinguishable by light microscopy from that of wild species (e.g. millets, sorghum). Reliance is thus placed on agrestal and secondary forest taxa, along with the declines exhibited by many moist lower montane forest pollen spectra. Contrary to Perrott's opinion, decreases even in such uncommon pollen types as Ebenaceae, *Musanga/Myrianthus* and *Parinari* are significant given their under-representation in the pollen rain and in view of the pollen diagram's absolute nature.

We still believe that the evidence, as a whole, signifies early forest destruction and burning and is a manifestation of human activity. We agree that there is no direct evidence as to why this might have occurred, although cultivation is most likely. We are continuing with our own research in the area, and await confirmation from archaeologists.

D. TAYLOR
A. HAMILTON

Department of Environmental Studies, University of Ulster, Coleraine, Co. Londonderry BT52 15A, UK

1. Hamilton, A., Taylor, D. & Vogel, J. C. *Nature* **320**, 164–167 (1986).
2. Hamilton, A. & Taylor, D. in *Sedimentation in the African Rifts* (eds Frostick, L. E. *et al.*) *Geol. Soc. Spec. Publ.* 23 (in the press).
3. Thompson, K. & Hamilton, A. C. in *Mires: Swamp, Bog, Fen and Moor, B. Regional Studies* (ed. Gore, A. J) 331–373 (Elsevier, Amsterdam, 1983).
4. Lind, E. M. & Morrison, M. E. S. *The Vegetation of East Africa* (Longman, London, 1974).
5. Hamilton, A. C. *Environmental History of East Africa* (Academic, London, 1982).
6. Smith, B. N. & Epstein, S. *Plant. Physiol.* **47**, 380–384 (1971).
7. Morrison, M. E. S. & Hamilton, A. C. *J. Ecol.* **62**, 1q–31 (1974).
8. Kendall, R. L. *Ecol. Monogr.* **39**, 121–176 (1969).
9. Hamilton, A. C. *Palaeocol. Afr.* **7**, 45–149 (1972).