

CORRESPONDENCE

The Editor,

Journal of Glaciology

SIR,

The glacial history of Antarctica

I very much appreciated Mr. Hollin's paper on the glacial history of Antarctica (Hollin, 1962), and in particular its "chief conclusion . . . that the greatest glacial fluctuations in Antarctica were produced by changes of sea-level" (p. 174) seems to me very important. However he makes another affirmation that I should like to oppose; it arises in his calculation of the time of accumulation of Antarctica.

Hollin takes the average annual accumulation to be approximately 14 g. cm.^{-2} and says that "ignoring ablation" an average thickness of 2,300 m. could be built up from ground level in less than 15,000 yr. (p. 175). He further assumes that the "gross ablation (sublimation, evaporation and run-off)" amounts to 1.5 g. cm.^{-2} at lat. 67° S. and 1 g. cm.^{-2} at lat. 85° S. Later on he points out that "the Antarctic Ice Sheet is not . . . 'static' or 'sluggish' or 'passive' but is in fact highly active. Indeed its mean velocity around its periphery of roughly 15,000 km. must be of the order of hundreds of meters per year." All of this I agree with—but these facts mean that the figure of 15,000 yr. is not the time it actually takes the ice sheet to accumulate!

Let us suppose that at the periphery with a velocity of 100 m./yr. ice with a thickness of only 100 m. is driven into the sea. That would give $1.5 \times 10^{17} \text{ cm.}^3$ of ice or $1.3 \times 10^{17} \text{ g.}$ of water—7.2 per cent of the annual accumulation of $1.8 \times 10^{18} \text{ g.}$ And the ice sheet may be some 300 m. thick, and its mean velocity much more than 100 m./yr. Indeed according to Hoinkes (1961, p. 368–69) Mellor assumes all the annual ice losses in the mass balance of Antarctica (ablation plus export of ice) to be $9.45 \times 10^{17} \text{ g.}$, while Kotlyakov even puts it as high as $1.32 \times 10^{18} \text{ g.}$ of water.

Glacier movement starts when glaciers are some 30 to 60 m. thick in the temperate zones; it may be that in the Antarctic the ice had to get a little thicker due to the different temperature and bed conditions, but it cannot be neglected entirely when calculating the time of accumulation of an ice sheet of continental dimensions, which might easily need five times the time that Hollin has supposed.

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REFERENCES

- Hoinkes, H. C. 1961. Die Antarktis und die geophysikalische Erforschung der Erde. *Naturwissenschaften*, Bd. 48, Ht. 9, p. 354–74.
Hollin, J. T. 1962. On the glacial history of Antarctica. *Journal of Glaciology*, Vol. 4, No. 32, p. 173–95.

SIR,

Although I wrote the words "ideally and ignoring ablation" deliberately in my paper, I think Dr. Heinsheimer raises a useful point when he says that ablation including ice flow is in fact important. In particular I accept that the main ice sheet, when it first grew, probably took more than 15,000 yr. to do so because of the ablation at its edge—but not very many times more. Published suggestions that the Antarctic Ice Sheet grew very slowly, taking 50,000 yr. or more, should be read with caution.

What I wished to emphasize in my paper was not so much the speed with which the ice sheet first grew, as the speed with which it adjusted itself to subsequent climatic, eustatic and other changes. An example of such a speedy change is given in a calculation I have given as part of the Cambridge symposium on mass balance studies (Hollin, 1962, p. 313).

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REFERENCE

- Hollin, J. T. 1962. Some problems of the Antarctic mass budget. *Journal of Glaciology*, Vol. 4, No. 33, p. 312–14.