

# matters arising

## *Trapa natans* in the British Flandrian

I WOULD like to make a palaeobotanical comment and to cite some further literature in reference to the paper by Flenley *et al.*<sup>1</sup>

The distribution of isolated post-glacial subfossil finds of *Trapa* (their Fig. 2) can be supplemented by three pollen finds from southern Norway (east of Oslofjord<sup>2</sup>) and a macrofossil (fruit) find from just north of Gävle in eastern Sweden<sup>3</sup> (61°N). At another, central Swedish site<sup>4</sup> pollen of *Trapa* was found to occur a little higher up the profile than fruits.

All these sites lie within the hypothetical climatic limit for *Trapa* during the climatic optimum (Atlantic and/or Sub-Boreal chronozones) drawn by Hintikka (ref. 5, Fig. 46), based on an extension of the present-day limits (mean temperature of the warmest month >17.5 °C and of the coldest month <1 °C) by Iversen's<sup>6</sup> postulated increase in mean July temperature of +2 °C. These values are corroborated by the meteorological data for subfossil and recent localities tabulated by Apinis<sup>7</sup>, who in addition draws attention to the critical period in May–June, during which a water temperature on the lake bottom of >12 °C is necessary for seed germination, and of September–December temperatures of 10 °C–1 °C for successful fruit ripening. Hegi (Flenley's ref. 3) states that flowering does not occur at water temperatures <20 °C.

Hintikka's fossil map only covers Fennoscandia, but comparison of the course of the 16 °C mean July isotherm<sup>8</sup> (interpolated for Fig. 9.2a) for recent time for Britain and western Denmark–southern Norway supports the possibility of subfossil occurrences of *Trapa* in Britain south of the Humber–Dee line (18 °C) in favourable aquatic habitats.

Habitat suitability needs stressing, however, particularly for outpost sites, as regards lake water depth, topography, sedimentation and water chemistry<sup>7,9,10</sup>. We are told too little about the site conditions at the Skipsea meres to draw any conclusions; or about any associated members of the aquatic flora (supporting macrofossil studies are required urgently!). The absence of subfossil finds of *Trapa* pollen or fruits at Hockham<sup>11</sup> or any other East Anglian meres could con-

ceivably arise from their (generally lime-rich) eutrophy (compare the frequent finds of *Najas marina* seeds and Flenley's ref. 1, pp.100–102), or that they do not lie on swan/goose migration routes, although human influence during the Neolithic and Bronze Age periods would surely have secured the introduction of *Trapa* as easily there as on Humberside? The best correlation between prehistoric sites and former *Trapa* lakes has been presented by Sundelin's<sup>12</sup> investigations in Småland, central southern Sweden, in which the absence of *Trapa* fruits from lakes to the north of his area was ascribed to climatic causes. Comparison with Hintikka's map shows a postulated negative 'inlier' in just that position. *Trapa* and man were obviously coeval there, but without <sup>14</sup>C datings it is hard to be certain that man got there first.

Although not disagreeing with Flenley that man may have had a 'finger in the *Trapa* pie' (although the 'Swan-mermaid legend' would explain both the Humberside and South Uist finds!), I cannot agree that "in which case it would not be necessary to invoke climatic change"; a more favourable local climate than that of the present day is a prerequisite for successful establishment and continued presence of *Trapa*. It is an annual and I can find no reference to overwintering by turions, only as fruits, although these remain viable for several years at least.

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- <sup>1</sup> Flenley, J. R., *et al.*, *Nature*, **257**, 39–41 (1975).
- <sup>2</sup> Danielsen, A., *Arbok Univ. Bergen, mat.-naturv. serie* 1969, no. 14 (1970).
- <sup>3</sup> Backman, A. L., *Geol. För. Stockh. Förh.*, **72**, 136–138 (1930).
- <sup>4</sup> Selling, O. H., *Geol. För. Stockh. Förh.*, **60**, 457–479 (1938).
- <sup>5</sup> Hintikka, V., *Ann. bot. Soc. "Vanamo"*, **34**(5), 1–63 (1963).
- <sup>6</sup> Iversen, J., *Geol. För. Stockh. Förh.*, **66**, 463–483 (1944).
- <sup>7</sup> Apinis, A. E., in *Pflanzensoziologie und Palynologie* (edit. by Tüxen, R.), 14–23 (Junk, Den Haag, 1967).
- <sup>8</sup> Lockwood, J. G., *World Climatology* (Arnold, London, 1974).
- <sup>9</sup> Pietsch, W., *Arch. Nat. Schutz. Landsh. Forsch.*, **12**, 121–151 (1972).
- <sup>10</sup> Valovirta, V., *Bull. geol. Soc. Finl.*, **188**, 41–65 (1960).
- <sup>11</sup> Godwin, H., and Tallantire, P. A., *J. Ecol.*, **39**, 285–307 (1951).
- <sup>12</sup> Sundelin, U., *Ymer*, **40**, 131–182 (1920).

FLENLEY AND MALONEY REPLY—We thank Tallantire for his valuable comments<sup>1</sup>, and we are sorry that he read our paper to imply that we were trying to explain all the northern European Holocene records as resulting from human activity. As we said originally

"explanations relating to man, however, deserve re-examination in the context of the new records".

In attempting to explain the new British records, we should like to make the following points. First, it is a general principle in ecology that a species cannot be assumed to occupy its full potential range in the field<sup>2</sup>. The entire ecological amplitude can only be established by comprehensive laboratory experiments. Although the experiments of Apinis<sup>3</sup> undoubtedly go some way towards this, they seem to relate more to specific phases (for example, germination, fruit ripening) than to the complete life cycle. Cultivated plants commonly occur well outside their 'wild' range.

Second, ecotypic differentiation may be expected to occur rather rapidly in an annual species, and the possibility of an extinct ecotype cannot be eliminated. Even in perennial species, ecotypic differentiation is very rapid<sup>4</sup>.

Third, we have investigated, in addition to the two meres which did contain both *Trapa* pollen and Bronze Age dwelling platforms, four other north Humberside former meres from which Bronze Age dwelling platforms have not been reported, and we did not find *Trapa* pollen in any of these. Of course, it is difficult to argue from correlations based on absence, which is why we did not adduce this evidence in the original letter. We note, however, that Tallantire refers to the absence of finds of *Trapa* in East Anglian meres.

Fourth, there seems to be some similarity between the Bronze Age dwelling platforms of north Humberside and those of Scandinavia<sup>5</sup> suggesting a possible former cultural connection.

We would not like the foregoing arguments to be taken to imply that we necessarily prefer the hypothesis of human activity to that of climatic change in explaining the former occurrence of *Trapa* in north Humberside; we are simply suggesting that minds should be kept open. Still less would we like it to be thought that we are necessarily against the idea of a climatic optimum; we simply suggest that the new British *Trapa* records may not demand this as an explanation.

- <sup>1</sup> Tallantire, P. A., *Nature*, **261**, 347 (1976).
- <sup>2</sup> Odum, E. P., *Fundamentals of Ecology* (Saunders, Philadelphia, 1971).
- <sup>3</sup> Apinis, A. E., in *Pflanzensoziologie und Palynologie* (edit. by Tüxen, R.), 14–23 (Junk, Den Haag, 1967).
- <sup>4</sup> Davies, M. S., and Snaydon, R. W., *J. appl. Ecol.*, **10**, 33–45 (1973).
- <sup>5</sup> Smith, R. A., *Archaeologia*, **62**, 593–610 (1911).