

2 **Supplementary file: methods**

3 In 2016 and 2017, coring was carried out with a Nordmeyer Geotool drilling rig with a windows
4 sampler with 60 mm outer diameter and a length of 1 m. The sediments were described in the field
5 and subsamples for macrofossil analyses were collected in the field (Table S2). Each layer was
6 sampled or a sample was taken at an interval of 1 m. In the laboratory, the sediment samples were
7 wet sieved and the residue left on the sieves was transferred to a petri dish. Macroscopic remains of
8 plants and animals were identified and counted using a dissecting microscope. In general,
9 preservation was good to excellent, but at some levels carbonate shells were somewhat dissolved. In
10 2019, open sections (labelled A/B in Fig. 1) were measured and sampled for radiocarbon dating
11 (Table S1) and macrofossil analyses (Table S3). A total of 87 samples have been analysed for
12 macrofossils.

13 Georadar data were collected in 2017 using the Sensors & Software pulse EKKO PRO system
14 with 250 MHz antennae that give a good resolution and a penetration up to 10 m.

15 Selected remains of plants and animals were dried and submitted for radiocarbon dating
16 (Table S1). A total of 12 samples were dated: six from the 2016 field work and six from 2019.
17 Dating was carried out at Beta Analytic in Florida, at the Ångström Laboratory, Uppsala University
18 and at the Aarhus AMS Centre, Aarhus University using accelerator mass spectrometry.

19 Terrestrial samples for radiocarbon dating were pre-treated by HCl followed by NaOH and
20 lastly by HCl. The samples were then converted to CO₂ by combustion. Shell samples were washed
21 and the outer 25% leached with HCl and treated with 100% phosphoric acid to liberate CO₂. The
22 carbon dioxide were converted to graphite and measured in the accelerator. The dating results are
23 reported according to international convention (Stuiver & Polach 1977) as conventional ¹⁴C dates in
24 ¹⁴C yr BP (before AD 1950) based on the measured ¹⁴C/¹³C ratio corrected for the natural isotopic
25 fractionation by normalizing the result to the standard δ¹³C value of 25‰ VPDB.

26 Radiocarbon ages were calibrated to calendar years before present (BP) using the programme
27 CALIB (<http://calib.org/calib/>), and we discuss only the calibrated ages in the text. For marine
28 samples, we used a reservoir age of 400 years. In the calibration program, this corresponds to a ΔR
29 value of 0. However, the local reservoir age may have varied in the past (Olsen *et al.* 2009), and
30 ages of marine shells are therefore more uncertain than ages of terrestrial plant species.

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32 **References**

- 33 Olsen, J., Rasmussen, P. & Heinemeier, J. 2009: Holocene temporal and spatial variation in the
34 radiocarbon reservoir age of three Danish fjords. *Boreas* **38**, 458–470.
35 <https://doi.org/10.1111/j.1502-3885.2009.00088.x>
36 Stuiver, M. & Polach, H. A. 1977: Reporting of C-14 data. *Radiocarbon* **19**, 355–363.