Portfolio Task 3: an exercise in environmental reconstruction

For this short exercise, you will be using data and visual information (primarily graphs) to reconstruct and summarise patterns in past sea ice incidence and air temperatures for the region around Iceland and southern Greenland over the last c. 1000 years. Before you begin, you will need to do the following:

- Listen to the recording of the lecture dated 16 Feb 2021 on MyAberdeen. This provides some background and context for the exercise.
- Download the Excel spreadsheet entitled 'Iceland sea ice dataset' (Table 1) from the 'Assessments' content area of MyAberdeen.

Part 1

(i) Using the dataset in Table 1, create a scatterplot of sea ice incidence (x) against mean annual temperature (y). Add a linear trendline to the scatterplot, and display both the equation and the R-squared (R^2) value for the relationship on the chart. Format the graph appropriately[1], then 'copy and paste' the graph to a blank MS-Word document. Add a figure caption beneath your graph. **(ii)** Using the equation you have generated together with Figure 1 (below), predict what the mean annual temperature was around the time of the settlement of Greenland (AD 1000) and at the time of its abandonment (AD 1450). Write your answers under your graph. (2 marks)

Part 2

Using all the sources of information made available to you here (Figures 1-3 below, and your information from Part 1), describe in concise terms how sea ice incidence and temperatures have changed in the western North Atlantic region over the course of the past c. 1000 years. We are interested in a summary of the broad pattern of change, not every minor 'wiggle' in each graph. Briefly comment on how you think any changes in sea ice incidence over time may have affected the ease of navigation/passage by boat across this part of the ocean over that same period. In your answer, make sure that you clearly identify any environmental 'tipping points' or critical thresholds apparent in the graphs. You should write no more than 400 words – excluding any references[2] – when answering. (4 marks)

Deadline and submission

Please submit your answers as a single document via the appropriate link (within the Portfolio folder) on MyAberdeen. **The deadline for submission of this task is 12:00 (midday) on Thursday 4 March 2021.**

References

Dugmore, A.J., Keller, C. & McGovern, T.H. 2007. Norse Greenland settlement: reflections on climate change, trade, and the contrasting fates of human settlements in the North Atlantic islands. *Arctic Anthropology* 44, 12-36.

Scott, M. & Hansen, K. 2016. *Sea ice.* NASA Earth Observatory. https://earthobservatory.nasa.gov/features/SeaIce. Last accessed: 12 February 2021.

[1] Essential elements of graph design are: adding axis labels (not forgetting any units of measurement); removing any unnecessary chart elements; resizing axes – where appropriate – to reduce areas of blank space. Other changes or enhancements can be made at your discretion.

[2] As an exercise in data analysis and interpretation, it should be possible for you to complete this exercise without reference to literature, though two supporting sources are provided that may help you to develop a deeper understanding of the subject material, and you are encouraged to read these.

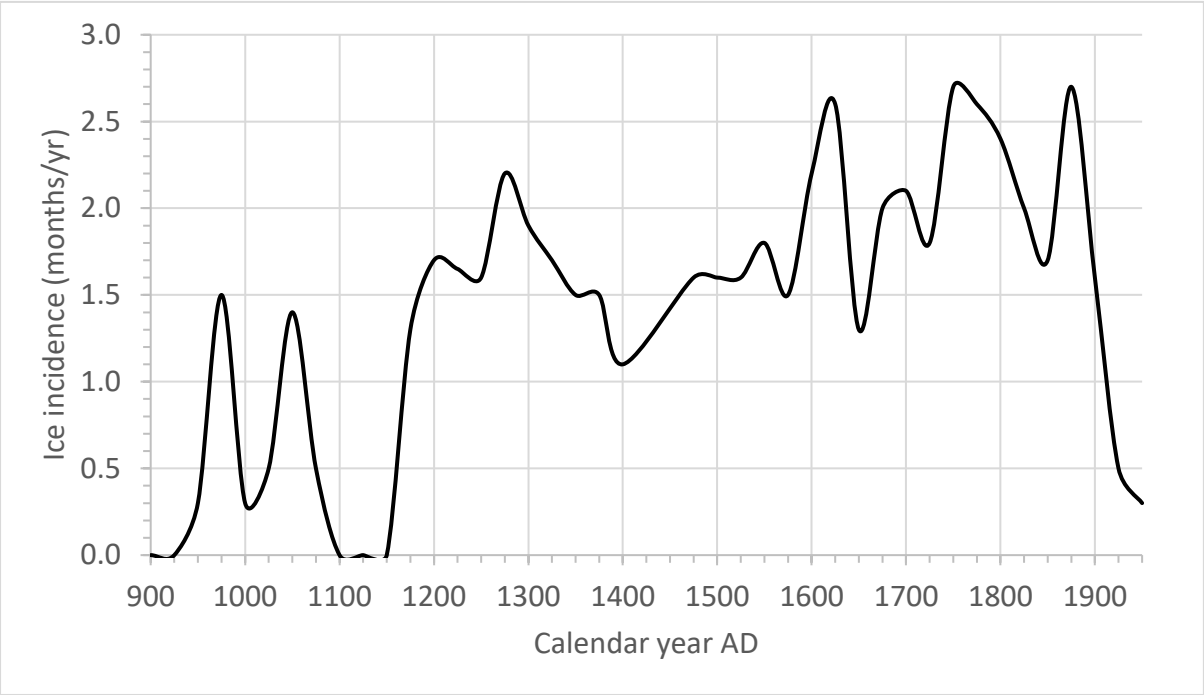

Figure 1: Sea ice conditions off Iceland over the last c. 1000 years. 30-year running mean reflecting direct observations (c. AD 1600 forwards) and estimates from documentary sources (pre-AD 1600). (Based upon data first presented in Bergthórsson, P. 1969. *Jökull* 19, 94-101).

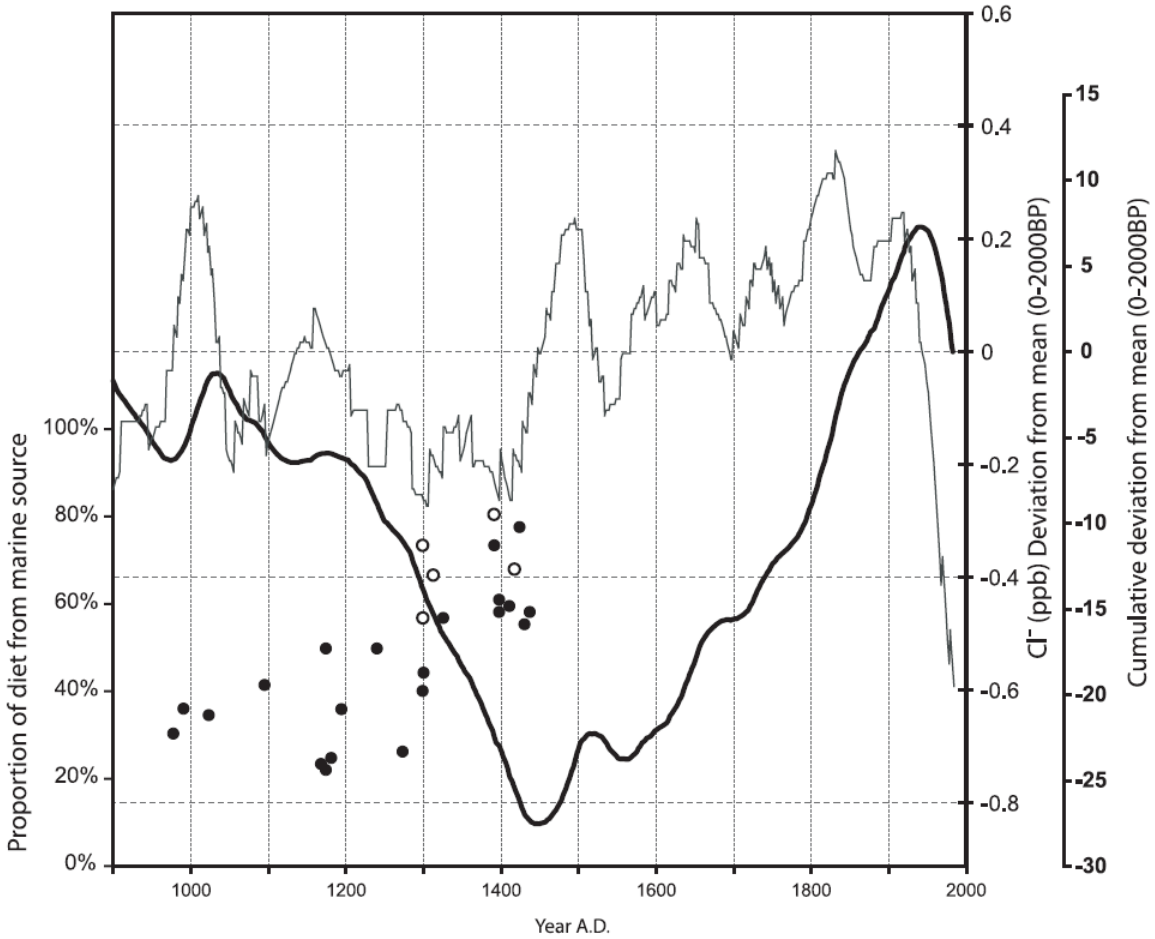

Figure 2: A proxy record for sea ice in the North Atlantic Ocean over the last millennium derived from the excess chloride (Cl^-) recorded in the GISP2 ice core (Source: Dugmore et al. 2007). Top graph (narrow line); 5-year running mean of deviations from the mean in parts per billion (ppb, ranging roughly from +0.38 to -0.85). Bottom graph (emboldened line); cumulative deviation from the mean (ppb, ranging roughly from +7 to -27). (Note: the point scatter represents a measure of the proportion of diet that the Norse people in Greenland were obtaining from marine sources. You may ignore this variable for the purposes of this exercise).

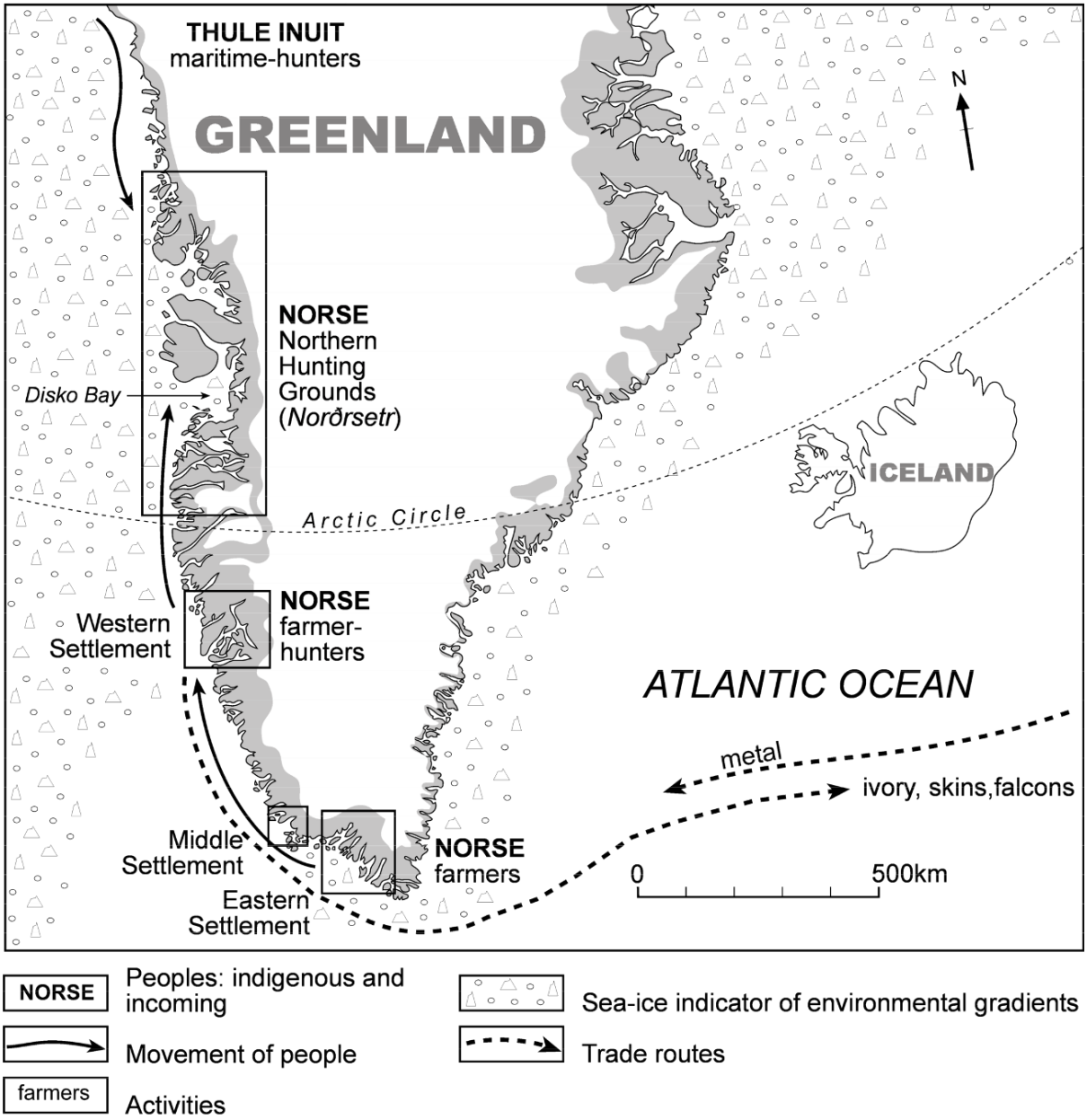

Figure 3: Map showing the location of Iceland and the Norse settlements in Greenland (boxed) in relation to the walrus hunting grounds (around Disko Bay), trade routes, and the areas normally affected by sea ice – stable and/or drifting (reflected by the iceberg symbols) – during the northern hemisphere spring and early summer seasons.