EaES 350 example test

1. Give a brief (max. 5 lines) explanation of the following terms:

a. Grainstone (10)
[limestone consisting of sand-sized carbonate grains of biological or chemical origin and essentially lacking carbonate mud]

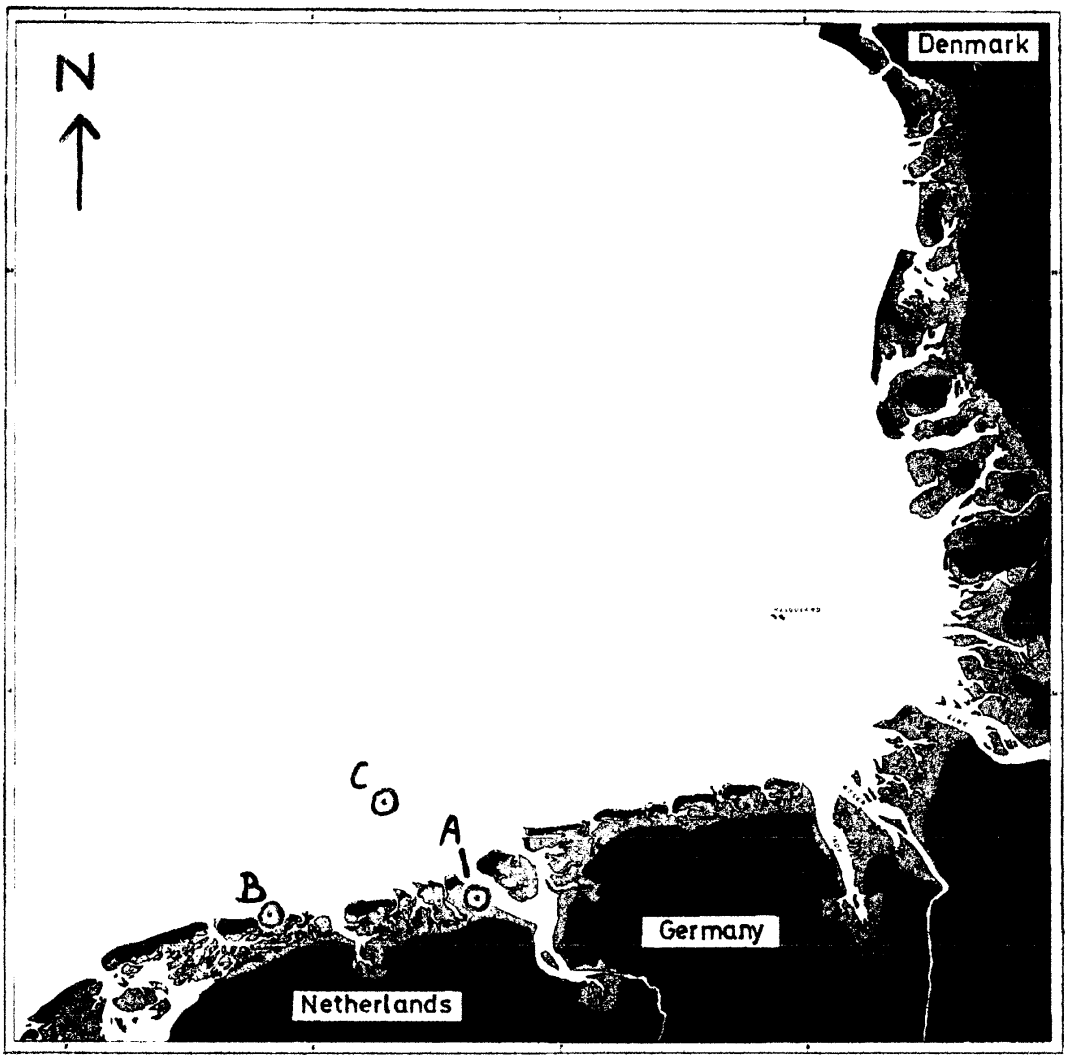
b. Froude number (10)
[dimensionless parameter indicating whether a fluid flow is subcritical or supercritical (flow velocity lower or higher than wave propagation rate, respectively)]

c. Preservation potential (10)
[likelihood of a deposit to be preserved in the stratigraphic record]

2a. Discuss at least two factors that constitute important controls on the porosity and permeability in sandstones. (15)
[sorting (poor sorting decreases porosity and permeability because fine grains fill the pore spaces between coarse grains); compaction (compaction decreases porosity and permeability by means of realignment of particles and pressure dissolution); cementation (cements fill pore spaces and thus decrease porosity and permeability]

2b. A layer of lodgement till has been deposited by a thick ice sheet in a subsiding basin and is ultimately buried at several kilometers depth to form a tillite. Argue what the porosity-depth curve for this deposit will look like. (15)
[due to the poor sorting of till, as well as a low water content at deposition (because of the high overburden pressure), the initial porosity is relatively low and there will be relatively little change with depth]

3a. The map shows the Wadden Sea along the coast of Denmark, Germany, and The Netherlands (NW Europe), which has developed in a mixed wave-tide setting with barrier islands separated from the mainland by extensive tidal flats. Seaward of the barrier islands is the North Sea, a typical shelf sea with water depths on the order of tens of meters. Based on the information you can obtain from the map, indicate which part(s) of the Wadden Sea would be most likely to be macrotidal (tidal range >4 m), and which part(s) you expect to be mesotidal (tidal range 2-4 m), and explain what this is based on. (20)
[the southeastern part is macrotidal (barrier islands are small or absent and river mouths form large estuaries); the Dutch (southern) and Danish (eastern) parts are mesotidal with longer barrier islands separated by smaller tidal inlets]



3b. Three sedimentary logs have been obtained from cores taken at different localities in this area (A, B, and C on the map). Unfortunately, they have been mixed up, so you are asked to sort out where each of them has been taken. You will want to base this on specific sedimentary structures that can be expected to be unique (or at least highly characteristic) for each of the three localities. Mention at least one diagnostic sedimentary structure for each locality. (20)

[site A (close to a tidal channel): mud-draped, large-scale cross stratification or other heterolithic stratification; site B (beach or upper shoreface): low-angle planar stratification or wave-rippled cross lamination; log C (further offshore on the shelf): hummocky cross stratification]