AGE-DEPTH PLOT PRACTICAL

Purpose
This practical provides a simple introduction to drawing age-depth plots and shows their value in identifying and analysing data anomalies. It is based on real data.

1. Construction of reference geomagnetic age-scale
The data in the table below gives distances of Quaternary and Early Pliocene sea-floor magnetic polarity anomalies from a spreading ridge, together with the radiometrically determined age of basalts from one of these anomalies.

a. Calculate the average sea-floor spreading rate.
b. Use this to estimate the ages of the reversal boundaries (assume linear spreading rate).
c. Plot the polarity history, using your estimated ages. (Draw this on the short edge of A4 graph paper with a scale of 5cm = 1Ma; black = normal; blank = reversed intervals)

Reversal	Polarity Change	Distance (km) from ridge axis	Inferred age (Ma)
1	N to R	14.6	
2	R to N	18.2	
3	N to R	19.6	
4	R to N	33.2	
5	N to R	37.6	
6	R to N	49.4	
7	N to R	58.4	
8	R to N	59.8	
9	N to R	61.6	
10	R to N	63.6	
11	N to R	68.0	3.40 (radiometric date)

2. Core V28-239
The five youngest polarity direction changes have been determined with high precision in Core V28-239, which was raised by the *R/V Vema* from the Ontong-Java plateau in the western equatorial Pacific (below the attenuated western end of the equatorial upwelling belt, and so a region of low/moderate productivity). In this core the first five reversal boundaries occur at the following sub-bottom depths: 7.26m, 8.77m, 9.40m, 15.33m, 17.81m

In addition a detailed biostratigraphic study of the core revealed that the last occurrence (LO) of the coccolithophore *Calcidiscus macintyrei* occurs at a sub-bottom depth of 13.65m.
a. Plot this data on the graph paper, along the long edge at a scale of 1cm = 1m
b. Draw an age-depth plot for the core and calculate the sedimentation rate.
c. Determine the age of the *C. macintyrei* datum.

3. Ocean Drilling Program, Site 658
ODP Site 658 (Leg 108) was drilled beneath an area of intense upwelling off NW Africa, resulting in unusually high sedimentation rates at this site.
There are polarity reversals at 109m (R to N), 125m (N to R) and 167.5m (R to N). On the basis spacing of these reversals and biostratigraphic data these are identified as reversals 4, 5 & 6.

Interpretation of the upper part of the core is less obvious; it is normally magnetised from the sediment-water interface to a sub-bottom depth of 101.5m, where a change to reversed polarity direction occurred. Biostratigraphic data from this part are (1) LO *C. macintyrei* between 100 and 102m , this datum occurs synchronously between the Atlantic and Pacific oceans, so the age calculated above can be used. (2) LO *Pseudoemiliania lacunosa*, between 68 & 70m, age estimate (from other studies) 0.47Ma.
a. Plot this data on the graph paper, along the long edge at a scale of 1cm = 10m
b. Draw an age-depth plot for the core and calculate the sedimentation rate for the different segments.
c. What are the possible different interpretations of the sedimentation history (there are at least three), and which is most likely (NB This is real data).