LABORATORY 2 - SEA FLOOR SPREADING

OBJECTIVES: *Use Marine Magnetic Anomaly patterns in interpreting the timing and nature of sea floor spreading in the world's oceans*

Several questions can be asked about the process of seafloor spreading. How temporally stable is the process - are spreading rates constant or nearly constant over geologic time spans? Is the process symmetric - are the same amounts of new lithosphere created on both sides of a spreading ridge? Are changes in spreading rates coincident globally? Were spreading rates similar to current rates when the oldest preserved lithosphere formed?

EXERCISE: Determine spreading rates across several ridge/ocean basins. Do this by selecting a profile across three regions: (1) the south Atlantic; (2) the southern Indian Ocean between Australia and Antarctica; and (3) across the old ocean basin with the M anomalies in the western Pacific. For all profiles complete the following:

> 1. Use the magnetic anomaly position and the reversal time scale to construct *detailed* distance (from ridge or inferred ridge) vs age plots for all profiles. Use all identifiable anomalies. Use the chronology given here rather than that shown on the map.
>
> Note: The map is a Mercator projection. As a global scale map, the conversion from map coordinates (x and y in millimeters measured on the map) to latitude is not linear. See separate notes for Mercator projection information.
>
> 2. Determine 'half-spreading' rates from your plots. More than one line segment may be required. Record this information on the plots.
>
> 3. Prepare a summary of the spreading episodes for each profile, including (but not limited to) time of initiation of spreading, periods of fast and slow spreading, symmetric or asymmetric spreading, and any other details you deem interesting or important.
>
> 4. Compare the various profiles. Comment on appearance of any synchronous behavior among the various ridge systems. Is there a global response to changes in spreading at one ridge system? Was spreading during the time of the M anomalies similar to more recent periods of spreading?

Note: All plots and graphs should be accurately plotted (graph paper or computer). Plots that are unlabeled (Titles, axes, curves) will not be considered in evaluating the lab. Use **tables** to collect and present the raw and processed data.

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Revised calibration of the geomagnetic polarity timescale for the Late Cretaceous and Cenozoic

Table 2. Revised Normal Polarity Intervals

Normal Polarity Interval, Ma	Polarity Chron
0.000 - 0.780	C1n
0.990 - 1.070	C1r.1n
1.770 - 1.950	C2n
2.140 - 2.150	C2r.1n
2.581 - 3.040	C2An.1n
3.110 - 3.220	C2An.2n
3.330 - 3.580	C2An.3n
4.180 - 4.290	C3n.1n
4.480 - 4.620	C3n.2n
4.800 - 4.890	C3n.3n
4.980 - 5.230	C3n.4n
5.894 - 6.137	C3An.1n
6.269 - 6.567	C3An.2n
6.935 - 7.091	C3Bn
7.135 - 7.170	C3Br.1n
7.341 - 7.375	C3Br.2n
7.432 - 7.562	C4n.1n
7.650 - 8.072	C4n.2n
8.225 - 8.257	C4r.1n
8.699 - 9.025	C4An
9.230 - 9.308	C4Ar.1n
9.580 - 9.642	C4Ar.2n
9.740 - 9.880	C5n.1n
9.920 - 10.949	C5n.2n
11.052 - 11.099	C5r.1n
11.476 - 11.531	C5r.2n
11.935 - 12.078	C5An.1n
12.184 - 12.401	C5An.2n
12.678 - 12.708	C5Ar.1n
12.775 - 12.819	C5Ar.2n
12.991 - 13.139	C5AAn
13.302 - 13.510	C5ABn
13.703 - 14.076	C5ACn
14.178 - 14.612	C5ADn
14.800 - 14.888	C5Bn.1n
15.034 - 15.155	C5Bn.2n
16.014 - 16.293	C5Cn.1n
16.327 - 16.488	C5Cn.2n
16.556 - 16.726	C5Cn.3n
17.277 - 17.615	C5Dn
18.281 - 18.781	C5En
19.048 - 20.131	C6n
20.518 - 20.725	C6An.1n
20.996 - 21.320	C6An.2n
21.768 - 21.859	C6AAn
22.151 - 22.248	C6AAr.1n
22.459 - 22.493	C6AAr.2n
22.588 - 22.750	C6Bn.1n
22.804 - 23.069	C6Bn.2n
23.353 - 23.535	C6Cn.1n
23.677 - 23.800	C6Cn.2n
23.999 - 24.118	C6Cn.3n
24.730 - 24.781	C7n.1n
24.835 - 25.183	C7n.2n
25.496 - 25.648	C7An
25.823 - 25.951	C8n.1n
25.992 - 26.554	C8n.2n
27.027 - 27.972	C9n
28.283 - 28.512	C10n.1n
28.578 - 28.745	C10n.2n
29.401 - 29.662	C11n.1n
29.765 - 30.098	C11n.2n
30.479 - 30.939	C12n
33.058 - 33.545	C13n
34.655 - 34.940	C15n
35.343 - 35.526	C16n.1n
35.685 - 36.341	C16n.2n
36.618 - 37.473	C17n.1n
37.604 - 37.848	C17n.2n
37.920 - 38.113	C17n.3n
38.426 - 39.552	C18n.1n
39.631 - 40.130	C18n.2n
41.257 - 41.521	C19n
42.536 - 43.789	C20n
46.264 - 47.906	C21n
49.037 - 49.714	C22n
50.778 - 50.946	C23n.1n
51.047 - 51.743	C23n.2n
52.364 - 52.663	C24n.1n
52.757 - 52.801	C24n.2n
52.903 - 53.347	C24n.3n
55.904 - 56.391	C25n
57.554 - 57.911	C26n
60.920 - 61.276	C27n
62.499 - 63.634	C28n
63.976 - 64.745	C29n
65.578 - 67.610	C30n
67.735 - 68.737	C31n
71.071 - 71.338	C32n.1n
71.587 - 73.004	C32n.2n
73.291 - 73.374	C32r.1n
73.619 - 79.075	C33n
83.000 -118.000	C34n

Table 3. Revised Cryptochrons Identified in Polarity Chrons C1 to C13 and C24 to C28

Interval, Ma	Cryptochron
0.493 - 0.504	C1n-1
1.201 - 1.211	*C1r.2r-1n
2.420 - 2.441	C2r.2r-1
8.635 - 8.651	C4r.2r-1
10.197 - 10.205	C5n.2n-1
10.446 - 10.470	C5n.2n-2
10.710 - 10.726	C5n.2n-3
17.825 - 17.853	C5Dr-1
24.475 - 24.486	C6r-1
25.338 - 25.354	C7r-1
26.347 - 26.359	C8n.2n-1
27.389 - 27.407	C9n-1
27.616 - 27.634	C9n-2
28.118 - 28.130	C9r-1
29.023 - 29.037	C10r-1
29.186 - 29.193	C10r-2
30.278 - 30.292	C11r-1
31.224 - 31.243	C12r-1
31.473 - 31.482	C12r-2
31.844 - 31.863	C12r-3
32.018 - 32.027	C12r-4
32.187 - 32.197	C12r-5
32.446 - 32.465	C12r-6
32.602 - 32.612	C12r-7
32.772 - 32.782	C12r-8
33.266 - 33.283	C13n-1

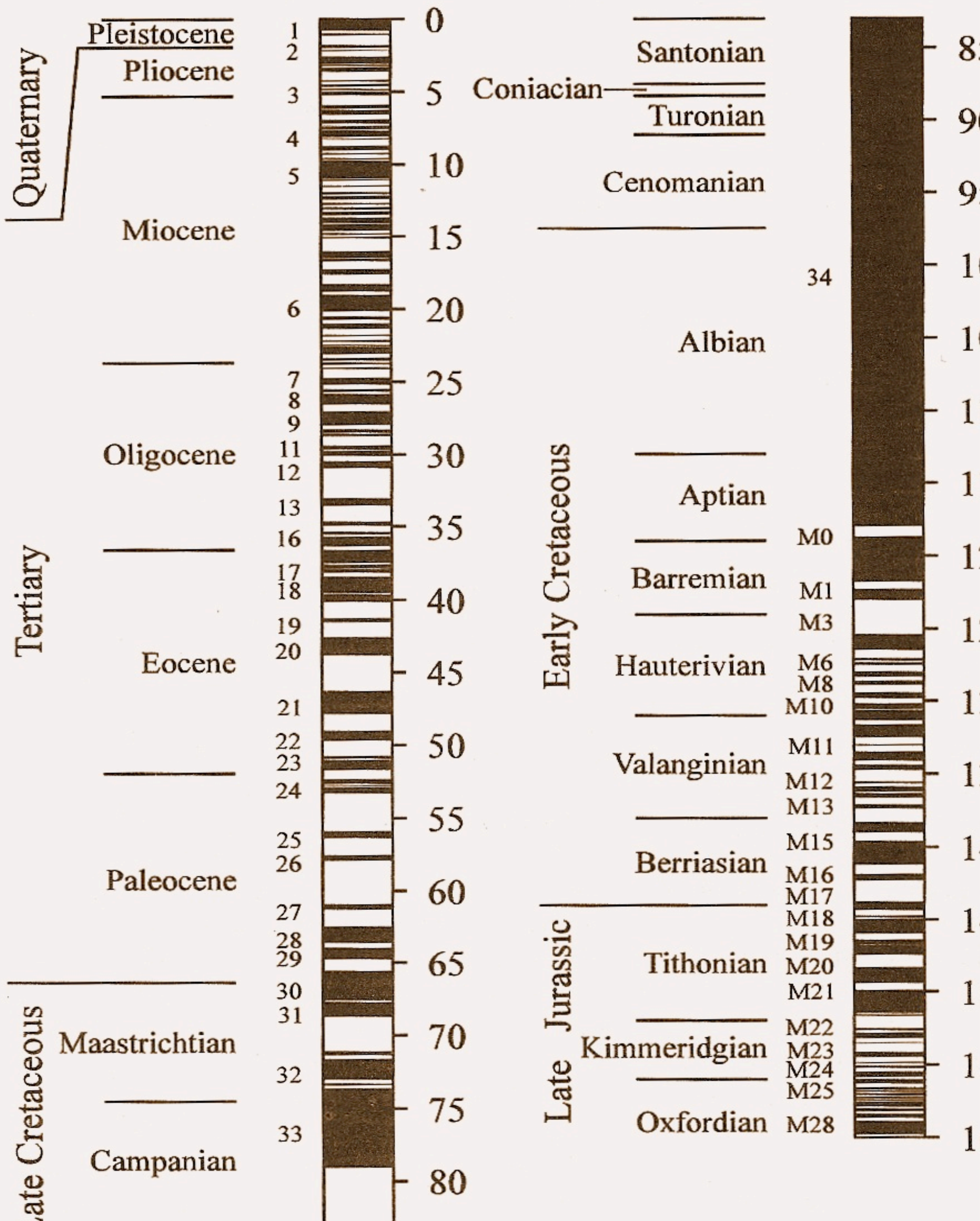

Fig. 5.10. Geomagnetic polarity time scale with magnetic anomaly numbers for the past 160 M using the combined scales of Kent and Gradstein (1986) and Cande and Kent (1995).