show zonal effects due to the earth's rotation. Zonal rotation—or equatorial acceleration—in a plastic mantle, underneath "rigid" crustal blocks, should have certain specific results.

For instance, major continental blocks in the Northern Hemisphere should, over the long term, describe counterclockwise loops. North America has had such a path, as has Europe. Present motions along the rim of the Pacific Ocean suggest that the North Pacific plate also has been following a counterclockwise loop.

Major continental blocks in the Southern Hemisphere should describe clockwise loops. This has been the pattern for Antarctica, Australia, and South America. Africa, located primarily in the Southern Hemisphere during Paleozoic time, traced a clockwise loop during that era; in Cenozoic time, largely in the Northern Hemisphere, it has been moving with counterclockwise curvature.

Further, major blocks close to the equator should have a greater west-to-east acceleration than major blocks located far from the equator. Hence, South America should be moving eastward relative to North America, and Africa should be moving eastward relative to Europe, North America, and South America. The northward paths of Europe and North America, relative to Africa and South America, also indicate major tensional effects in the Mediterranean and Gulf of Mexico-Caribbean areas.

The Northern Pacific block should be moving eastward faster than the North American block as it is closer to the equator, and should be turning in a counterclockwise sense. This movement provides a north-south zone of east-west compression along the western edge of North America and down the East Pacific Rise.

Reconstruction of block paths indicates that Gondwanaland, a hypothetical Paleozoic supercontinent, was more likely a convergence of individual blocks which had separate previous histories.

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NEGATIVE EVIDENCE AND PLEISTOCENE HISTORY

Studies of Florida, the Yucatán, and other nearby coastal areas have shown that (outside of tectonically disturbed belts), there are no Pleistocene reefs more than 10 m above present mean sea level. If interglacial times produced complete ice-cap melting, and a concomitant mean sea level rise, reef-building organisms should have flourished (a) farther north than now, and (b) higher above sea level than now. This distribution has not been found.

These studies also have shown that there are no obvious large pre-Sangamon coastal deposits away from major deltas. If the Sangamon and the Holocene were typical of Pleistocene interglacial times, then classical theory requires at least 2 more such deposits (Aftonian and Yarmouth). They either are not present or, if present, are not nearly as extensive as Sangamon accumulations.

Further studies of these areas have shown that there are no high flights of Pleistocene marine terraces. Those terraces within the study area commonly mapped as Pleistocene are very low features of Sangamon and Holocene age, or are higher features of Pliocene and Miocene age, or cannot be dated.

Several conclusions were made from these studies.

1. The cooling which brought on late Cenozoic ice ages must have occurred in the late Tertiary, rather than in the Quaternary.

2. Melting of the full set of ice caps, during Quaternary time, was never complete, including the present.

3. Sea level, in Quaternary time, never stood much higher than it is today.

4. Aftonian and Yarmouth sea levels were (a) slightly lower than in Sangamon and Holocene time, or (b) did not maintain a position, similar to now, long enough for significant deposits to be made, or (c) maintained such a position for so long that almost all deposits were removed by erosion.

5. The next long-term trend—barring short-term fluctuations—must be one of climatic cooling and a marked drop in mean sea level.

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PETROLOGY AND DIAGENESIS OF TERTIARY AQUIFER CARBONATES, NORTH CAROLINA

Superior stone quarry near New Bern, North Carolina, exposes 9.2 m of Eocene Castle Hayne Limestone that is disconformably overlain by 2 m of an unnamed Oligocene carbonate unit. Both form part of the most important aquifer system in eastern North Carolina.

The Eocene Castle Hayne strata are divisible into 2 massively bedded facies: (A) a sandy, pelecypod-mold biomicrudite with microspar and pseudospar matrix, and (B) a sandy, pelecypod-mold biosparite and biosparrudite, which grades westward into calcareous quartz sand. Facies A consists of unabraded pelecypod valves (dominantly molds of aragonite *Macrocallista* shells) and 20% by volume of moderately well-sorted, fine quartz sand that are set in microspar and pseudospar. Facies B consists of pelecypod valves (chiefly molds of worn, fragmented, and unabraded *Macrocallista*) and 27% of well-sorted, fine quartz sand. Sparry calcite cement forms 41% of this facies. Subordinate allochems in both are gastropods, foraminifers, bryozoans, echinoderms, ostracods, intraclasts, peloids, glauconite, and bone. Facies A is a low-energy, shallow-marine bank that accumulated seaward of Facies B, which was deposited in a higher energy nearshore environment.

The Oligocene stratum is a sandy, molluscan-mold biomicrudite consisting of pelecypods, turritellid and naticid gastropods, and scaphopods (all as molds of unabraded aragonite shells) that are set in micrite. Fine, moderately well-sorted quartz sand forms 3% of the unit. Other allochems are echinoderms, foraminifers, peloids, ostracods, and bone. This is an inner or middle-shelf deposit that accumulated below wave base.

Upon subaerial exposure, the following diagenetic changes occurred: (1) high-Mg calcite skeletons, mainly echinoderms, recrystallized to low-Mg calcite, (2) most aragonite skeletons dissolved to form molds, and the carbonate either precipitated nearby as low-Mg calcite cement, or neomorphed to spar, (3) molds were reduced or filled with low-Mg spar, and (4) micrite and pelmicrite aggraded to microspar and pseudospar.

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HIGH-RESOLUTION, SUBBOTTOM PROFILES AND SEDIMENT CHARACTERISTICS OF MISSISSIPPI DELTA

High-resolution subbottom profiling and sediment coring within a 100-sq mi area off South Pass of the Mississippi delta have resulted in: (1) a detailed bathymetric chart of the area; (2) a three-dimensional structural chart of the sediments to a subbottom depth of 100 m; and (3) characterizing the surface sediments in terms of lithology, shear strength, water content, bulk density, and compressibility.

The bathymetric chart was constructed on a 1/2 mi grid supplemented by surveys of the area of other agencies. One of the more interesting features of the area was the delineation of a series of gullies. These features are compared with those contoured by F. P. Shepard in 1940.

The seismic data revealed that the subbottom structure of the delta front and of the area seaward is characterized by numerous slump features. The sediment in the area is classified as a high water content, low shear strength, underconsolidated, rather homogeneous silty clay.