

BOUNDARIES OF PENNSYLVANIAN CYCLOTHEMS¹

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Many geologists believe that the top of the coal bed or the base of the marine members, if coal be absent, should constitute the boundary between cyclothems. Some favor the base of the coal. The writer contends that the base of the sandstone is the most logical boundary. Three other suggested horizons are believed to be unimportant and are not considered here.

It is generally agreed that diastrophism offers the best means for the major subdivision of geologic time and it is only logical that it be employed in minor subdivision if possible. Diastrophism is preeminently suggested at two horizons in the cyclothem: (1) at the top of the coal when the basin sank beneath the sea, and (2) at the base of the sandstone when the basin was elevated. The base of the coal does not clearly record a diastrophic movement and if the importance of diastrophism be admitted the unsuitability of this horizon as a boundary must be recognized.

According to the original conception, sedimentary cycles consist of beds deposited during a single incursion of the sea, separated by unconformities that represent periods of emergence. With the introduction of nonmarine beds in alternation with marine sediments the question arises, should these be included with the under or overlying marine cycle. By choosing the top of the coal as the boundary the nonmarine beds are included with the preceding marine cycle for which there appears to be no specific reason except local convenience.

In a basin of deposition, subsidence must be dominant. The particular subsidence that allowed submergence conforms to this general movement and is not necessarily unique. Uplift in the basin, however, would constitute a conspicuous irregularity, promptly recorded by change in sedimentation and perhaps by unconformity, and would furnish a more significant basis for cyclical differentiation.

Most important cycles of erosion have probably influenced sedimentation in adjoining basins so strongly that corresponding sedimentary cycles have been produced. Erosion and deposition are phases of a single physiographic process and the cycles of erosion and deposition should be defined with corresponding limits. Cycles of erosion are initiated by uplift and the early sediments produced are the coarsest. Therefore, the cycle of deposition should also be initiated by uplift, if uplift of the basin occurred, and the coarsest sediments should be considered the basal deposit.

The base of the sandstone is the logical boundary between cyclothems because (1) uplift of the basin is most strongly suggested, and unconformity most conspicuous at this horizon, and (2) the cycle of sedimentation is made to correspond with a possible related cycle of erosion. A boundary corresponding to the top of the coal can be recognized only where a coal horizon is present or marine beds overlie other types of nonmarine strata. The horizon corresponding to the base of the sandstone, however, can probably be recognized by change in sediment far beyond the limits of these members and is, therefore, probably of much wider application. Consequently this boundary is superior practically as well as theoretically.

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