were delivered from the continental interiors onto the young passive margins. In time, river drainage became increasingly focused, concentrating detrital sediment supply at the mouths of a few large rivers. Very large supplies of detrital sediment require large, high uplifts such as those caused by subduction of young, hot ocean crust or by continental collision.

Large sediment supplies also require drainage basins with relatively constant slope; so that sediment erosion, throughput, and delivery to the ocean margin are efficient. The result is rapid sedimentation of deltaic complexes containing an abundance of organic carbon. During most of earth history, there are no large, high uplifts, and carbonate rocks become more important in the continental margins.

In contrast to the point inputs of detrital sediments, the supply of carbonate has been from the oceanic reservoir and is diffuse. Carbonate deposition dominates the continental shelves in all warm regions where the detrital sediment input is not extremely large. Carbonate shelves become cemented, resisting erosion, so they build up until the shelf edge approximates highstands of sea level. Detrital shelves become adjusted to lowstands of sea level with the shelf breaks typically many tens of meters below the low sea level.

The clastic-carbonate shelf-slope-rise system operates to promote bypassing of detrital materials into deep water in the subtropics and tropics, with sharp facies contrasts. In higher latitudes, carbonate may be a significant proportion of the continental margin material, but facies changes are usually much more gradual.

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## Application of Database Management to Biostratigraphy

The nature of biostratigraphic data presents major problems that are not considered by most computerized database-management systems. These problems include the variety of ways that paleontologists record data, the reluctance of many paleontologists to use the computer, the need to change the database to reflect the current state of biostratigraphy, and the need to separate the paleontologic information from interpretive and nonpaleontologic information. With regard to the first problem, the level of paleontologic measurement (e.g., presence-absence, qualitative assessments of abundance, or counts) should be retained for each sample; yet the system should be designed so that data with varying levels of measurement can be reduced to their lowest form allowing comparisons among samples with different levels of measurement. For example, in a series of wells to be correlated, a combination of presence-absence information, qualitative assessments, and counts of fossils may be present. In this example, one wants the opportunity to automatically reduce all data to presence-absence form and correlate the wells.

The second problem presented to the management of biostratigraphic data is the reluctance of paleontologists to utilize the computer. To minimize this problem, the database-management software must be designed to run as efficiently and simply as possible so each user feels that the system was designed specifically for him. In addition, the design of the system should be flexible enough so that the user can request minor modifications in the system to meet his own needs.

With regard to the final problem, paleontologic data must be separated from both interpretative (e.g., zonal and age assignments) and nonpaleontologic (e.g., formational assignments) information. It is highly desirable to assign quality factors to the data, so that high-quality data is distinguishable from data produced in a quick-and-dirty fashion.

Many of these problems have been resolved using an efficient, relational database-management system designed for a variety of paleontologic and related data linked with a series of biostratigraphic applications programs. The internal structure of the database as well as the applications programs are hidden from the user, who only sees a series of panels that allow easy, efficient execution of the entire package. This package expedites report writing, analysis of data from a single well, regional synthesis of data from many wells and outcrops, and integration of biostratigraphic data with other types of geologic information.

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## Ocean Margin Drilling Project Data Synthesis off Eastern North America: 28 to 36 Degrees North Latitude

An atlas of geological and geophysical maps has been compiled for the east coast of the North American continent covering an area from well onshore to the ocean crust, and from 28 to 36° N as part of the Ocean Margin Drilling Project.

Included in the atlas are maps of the depth to continental and oceanic basement, depth to the top of Lower and Middle Jurassic (reflectors $J_M/J_2$ and $J_S/J_2$), to the top of Jurassic (reflectors $J/J_1$), to the top of Neocomian (reflector Beta), to the top of Cretaceous (reflector A*), to the top of Paleogene (reflector $A_u$), and to the top of lower Miocene (reflector X). Isopach maps between these reflectors and between them and the seafloor are also included. Contours are two-way travel time with a contour interval of 0.25 to 1 sec.

The atlas also contains a tectonic map of basement, a pre-Quaternary geologic map, and lithofacies maps for six time slices.

There are geophysical maps of magnetic and gravity anomalies and compressional wave velocities in sediments and basement.

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## Evolution of Sedimentary Basins

Simple extensional models that involve stretching by listric faulting in the brittle upper crust and plastic flow in the lower lithosphere have been shown to account for the subsidence history of various sedimentary basins, continental shelves, and the Central graben in the North Sea. The case where extension thins the crust by a different amount from the subcrustal lithosphere has been considered by several authors, but their treatment of two-layer extension is overly complicated and partly incomplete. In this paper, we present a simplified analysis of the two-layer extensional model for the elementary case in which extension is instantaneous, the crust is thinned by a different amount from the subcrustal lithosphere, the effects of radioactivity and dike intrusion are ignored, and local isostatic compensation is assumed at all times. We show how the thinning parameters can be obtained from the subsidence data through the use of a simple and powerful method of data analysis. We show that conservation of mass during a process of non-uniform extension implies that much greater thicknesses of sediment can be deposited in a young basin than in the case of uniform extension of both crust and subcrustal lithosphere. Further, we show that such an extensional process produces significant uplift of the flanks of a graben and that, as a result of erosion of the uplifted areas, the effective area of the basin can be increased as much as 25 to 30%, depending on the rate of erosion, compared to the area that