grainstones and ooid-rhodolite packstones and grainstones. In the easternmost part of the study area, ooid grainstones grade updip into lower energy lagoonal facies including pellet and *Favreina* wackestones and packstones. These lagoonal deposits are not as widespread to the west. Lower in the Smackover, low-energy skeletal, pellet and oncolite wackestones and packstones dominate. Two cores contain coralgal fragments suggesting nearby reef development.

The overlying lower Buckner Formation is composed dominantly of red beds and evaporites deposited in a sabkha setting. The presence of thick red beds in cores from the western part of the study area suggests a strong continental influence. Anhydrite is the major evaporite mineral in the lower Buckner. It is present as displacive mosaic and nodular mosaic masses in red beds and dolomitic mudstones. Partial preservation of some original gypsum crystal outlines provides evidence for lesser amounts of primary evaporite precipitation. Small amounts of halite are present in some lower Buckner red beds and associated with anhydrite to the west. Environments and depocenters within the Buckner are thought to have ben partly controlled by movement of the underlying Louann Salt and by rejuvenation of basement structures.

Major structural influences on Smackover and Buckner deposition or present distribution include the Mexia-Talco fault system, the Sabine uplift, and Louann salt structures. Movement along the Mexia-Talco fault system began in Late Jurassic time and may have affected Smackover and Buckner deposition to an as yet undetermined extent. The extent of the influence of the incipient Sabine uplift on deposition in east Texas has not been determined, although studies to date suggest that it had a significant effect on facies development and on the configuration of the Smackover-Buckner carbonate shelf and associated basin.

The major influence of Louann Salt movement on Smackover and Buckner deposition is confined to the western half of the study area. Salt movement began after the close of Smackover time. Withdrawal of Louann Salt into ridges formed a series of strike-trending linear troughs in the western part of the study area. The Buckner Formation thickens dramatically within the linear troughs, suggesting possible salt movement during Buckner time.

A second linear zone of thickened Buckner section, apparently unrelated to Louann Salt movement, lies to the northeast of the area of salt structures. This strike-oriented Buckner depocenter is well developed in the east and pinches out to the west. Salt is present within the Buckner in the western part of the depocenter.

Cross sections constructed from electric logs and data from core analysis demonstrate these relationships and may help delineate potential areas for hydrocarbon exploration.

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Structural Stratigraphy of Austin Chalk

The mechanical behavior (structural stratigraphy) of the Upper Cretaceous Austin Chalk is established from the study of fracture intensity along its outcrop trend from Dallas to San Antonio and westward to Langtry, Texas, and in the subsurface from the study of core and/or fracture identification logs from 39 wells. Three mechanical-stratigraphic units are recognized as: (1) an upper, fractured massive chalk corresponding to the Bid House Chalk Member, (2) a middle, ductile chalk-marl corresponding to the Dessau Chalk and Burditt Marl Members, and (3) a lower, fractured massive chalk corresponding to the Atco Chalk Member.

Representative samples from these units were experimentally shortened dry, at 10, 17, 34, and 70-MPa confining pressure, 24°C (75°F), and at $2.5 \times 10^{-4}\ s^{-1}$ to determine if the relative mechanical behavior observed at the surface could be extrapolated into the subsurface at different simulated depths of burial. The experimentally determined ductilities do parallel those determined from outcrop and subsurface studies. Through multiple linear regression analyses of strength versus intrinsic rock properties and environmental parameters, it appears that first porosity and then smectite-content are most strongly correlated with strength. For low-porosity specimens (9 to 13.5%) smectite present in amounts as little as 1% by volume has the highest correlation with strength accounting for 83% of its variability. For example, the strength of specimens with 4% smectite is reduced by a factor of 2 compared to those with no smectite. The coefficient of internal friction at 70-MPa confining pressure decreases from 1.58 to 0.57 as the smectite content increases from 0 to 1 to 4%.

SEM photomicrographs of the experimentally deformed specimens show that smectite and other clays are distributed as small, discrete, concentrated masses throughout the chalk. They are smeared-out along the induced shear fracture surfaces where they are greatly reduced in grain-size. These observations suggest that the smectite acts mechanically as a "soft-inclusion," localizing shear failure and correspondingly weakening the material.

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Eocene-Oligocene Benthonic Foraminifera: Implications for Deep-Water Circulation History

Quantitative analysis of middle Eocene-early Oligocene bathyal deep-sea benthonic foraminifera was carried out on samples from DSDP Sites 77, 292 (Pacific Ocean), 219 and 253 (Indian Ocean), 363 (Atlantic Ocean), and Eureka 67-128 (Gulf of Mexico) and compared with benthonic foraminiferal stable isotopic data to determine the effects of deep-water circulation changes on the faunas, Faunal changes (first and last occurrences) are found throughout the sequences, and a catastrophic turnover of the benthonic foraminiferal fauna at the Eocene-Oligocene boundary does not occur. A few distinct events do occur associated with inferred coolings at the middle/late Eocene and Eocene/Oligocene boundary. For example, *Nuttallides truempyi*, an important middle Eocene species, has an isochronous last occurrence within the *Globigerinatheka semiinvoluta* zone in Sites 219, 253, 292, and 363 and coincides with a 3° deep-water cooling inferred from the O^{18} record.

During the late Eocene and early Oligocene these bathyal sites are marked by a remarkably uniform assemblage dominated by *Oridorsalis tener, Globocassidulina subglobosa*, and *Cibicidoides ungerianus*. In Sites 292 and E67-128 additional species that are important are *Bulimina alazanensis, Buliminella grata*, and *Bulimina tuxpamensis*. This relatively uniform bathyal faunal assemblage in these Atlantic, Indian, and Pacific sites is similar to an assemblage found previously in North and South Atlantic bathyal sites. This faunal pattern, as well as the isochronous last appearance of *N. truempyi*, suggests that a relatively uniform and widespread bathyal water mass extended throughout the world ocean during middle Eocene-early Oligocene time.

The faunal data show three responses to the sharp deep-water coolings at the middle/late Eocene and late Eocene/early Oligocene boundary: (1) a dominant species may have a last occurrence as a direct result of the cooling, (b) an increase in species abundance precedes the cooling followed by a sharp decrease associated with a decrease in deep-water temperatures, or (c) a species is largely unaffected by the temperature change.