Phase III have confirmed the complex nature of the oil-bearing facies. Furthermore, SEM and thin section analyses have determined additional controls on fluid flow, mainly reduction in permeability by ductile rock fragment deformation and intergranular clay and mica.

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Uranium Industry Outlook from a Banker's Perspective

This paper will discuss the technical fundamentals underlying the uranium industry: reserves, supply vs demand, and the geographic changes anticipated in the industry to the year 1995. Particular emphasis is placed on the economics of the uranium industry including the price outlook for U-308. Given this outlook, a brief outline of the various criteria important in financing uranium producers rounds out the banker's viewpoint on the viability of the industry.

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Distribution of Paleocene-Eocene Benthic Foraminifera in Atlantic

A study of Paleocene-Eocene deep sea benthic foraminifera from DSDP sites in the Atlantic, Caribbean, and the Gulf of Mexico, reveals two major faunas: (1) a Paleocene fauna dominated by Cretaceous relict species, and (2) an Eocene fauna characterized by many new faunal elements. An abrupt faunal turnover, resulting in the extinction of almost all Cretaceous species, occurs during the latest Paleocene (Zone P6a). Using the "backtracking" method of Berger, the relative plate motions of Phillips and Forsyth, and the paleomagnetic data of McElhinny, the paleobathymetric and paleolatitudinal distribution of benthic forams was studied. A principal component analysis identifies three distinct Paleocene and four Eocene assemblages. A *Gavelinella beccariiformis* assemblage, with a wide bathymetric range during the early Paleocene, becomes restricted to shallower water during the late Paleocene before becoming extinct in Zone P6a. A deep water *Nuttallides* assemblage, consisting of long-range taxa, follows this trend, occurring at intermediate depths during the latest Paleocene. A third assemblage, with predominantly *Nuttallides crassaformis* and various buliminids, is restricted to the low-middle latitudes. In the Eocene the *Nuttallides* (mainly *N. truempyi)* becomes restricted to deep water prior to its extinction in the late Eocene, when it is replaced by a previously shallow assemblage characterized by *Cibicidoides ungerianus* (2). A second trend discriminates between a shallow assemblage (3) with *Lenticulina, Osangularia mexicana,* and various buliminids, which is most prominent during the middle Eocene, and a deep assemblage (4) with *Globocassidulina subglobosa, Gyroidinoides, C. ungerianus, Stilostomella aculeata,* and *Oridorsalis umbonatus,* which is most prominent during the middle and late Eocene.

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Triassic Paleogeography, Evaporites, and Stromatolites of Southwest Britain

During Triassic time, northwest Europe was subjected to tensional stresses which resulted in the formation of a complex system of rapidly subsiding grabens and wrench-faulted basins. This pattern of regional crustal extension, which is part of the Mesozoic breakup of the Pangean megacontinent, is related to the Triassic opening of the Tethys ocean in southern Europe and rifting in the Arctic North Atlantic, and is a prelude to the Jurassic opening of the southern North Atlantic. Great thicknesses of chiefly continental (non-volcanic) sediments accumulated within the Triassic basins. Within western Britain, a complex series of fault-bounded basins extended from the western approach and channel area, northward to the Irish Sea.

Sediments within the Triassic basins of southwest Britain generally conform to a pattern. In the basin center, haline and marls predominate, and toward the basin margin halite gives way to gypsum-anhydrite (commonly replaced by quartz, dolomite, and calcite). Where highland regions occur at basin margins, alluvial fan sequences are developed and interdigitate down-fan with marls. Beach breccias and shore-flat deposits occur in some marginal areas, as well as wave-cut platforms carbed into Carboniferous limestone bedrock. At times the fault-bounded basins contained substantial water bodies ("lakes") from which the halite was precipitated, and around which beaches developed. Contraction of the lakes produced polygonal structures in the halite and calcretes within basin margin deposits. A rare but interesting marginal facies is that of a hyposaline limestone containing fine stromatolites, fenestral fabrics, and tepees.

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Influence of Time Dependent Thermal Histories on Conversion of Kerogen to Petroleum

The conversion of kerogen to petroleum is a thermally activated process. Many alternative forms of the rate equations have been proposed. Usually it is assumed that the present geothermal gradient has been unchanged in the past and the fractional conversion is determined. In this paper three limiting examples of time dependent thermal histories are considered: (1) a sedimentary basin is formed by thermal subsidence on initially hot lithosphere; (2) isothermal (cold) sediments are deposited instantaneously on crust with a constant (time independent) thermal gradient; and (3) a transient thermal event, i.e., a volcanic sill or dike, heats cool sediments. In each example, the conversion of kerogen to petroleum is determined and is compared with the steady state hypothesis.

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Model for Barrier Island–Tidal Inlet Stratigraphy

A three-dimensional stratigraphic model for a tidal inlet-barrier island facies was constructed through examination of 37 vibracores and 10 auger drill holes on Capers and Dewees Islands, South Carolina. Two cycles of southerly inlet migration and subsequent abandonment resulted in beach ridge truncation on the northern ends of the barriers. The inefficiency of overextended migrating inlet channels caused shorter northerly oriented channels to breach the ebb-tidal delta. Inlet reorientation allowed a large wave-formed swash bar to migrate landward, attach to the barrier, and close the former inlet channel.

Price Inlet formed during the onset of the Holocene transgression by submerging the ancestral Pliocene-Pleistocene

Santee River drainage system. Coarse, poorly sorted sand disconformably overlies Pleistocene estuarine clays and is capped by a dense clay plug. Beach ridges prograded seaward over the first inlet sequence. A second cycle of inlet migration truncated the northernmost part of the beach ridges and scoured into the inactive-fill clay plug of the earlier inlet deposit. The resultant stratigraphic framework consists of a stacked series of upward fining, active inlet-fill sands overlain by thicker inactive inlet-fill clay plugs.

Migrating tidal inlets greatly alter barrier island stratigraphy. Reworked beach ridge sediments are incorporated into tidal inlet channels preserved on the updrift end of the barrier island. Fine-grained clay plugs form permeability barriers between adjacent barrier island sand bodies. Shoreline transgression will remove the uppermost barrier island deposits sealing the lower inlet-fill sequences between Pleistocene estuarine clays and continental shelf silts and clays.

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Sedimentary Facies Within Coastal Belt Franciscan Complex, Garberville Quadrangle, Northern California

Mildly deformed shale and sandstone, exposed along the South Fork of the Eel River in the Garberville Quadrangle (northern California Coast Ranges), are thought to represent a distinct lithofacies of the coastal belt Franciscan complex. These rocks have been correlated with the so-called Yager Formation, exposed farther to the north. Near Garberville, the folded sandy turbidites and shales are probably Eocene or younger in age, and are in contact with three other tectonostratigraphic units: (1) melange of the Franciscan central belt; (2) deformed sedimentary rocks of the coastal belt and King Range, exposed to the west; and (3) younger (Miocene-Pliocene) shelf deposits, which resemble the Wildcat Group of the Eel River basin.

Regional mapping of turbidite facies (using the Ricci-Lucchi scheme) shows that a high percentage of the section consists of hemipelagic mudstone and shale; these facies G deposits are commonly interbedded with thin facies E silty turbidites. Locally, the fine-grained strata pass abruptly into sequences of thick-bedded to massive facies B sandstone and associated facies C turbidites. At one locality, thinner facies D turbidites are abundant within a thickening-upward and coarsening-upward sequence that is over 100 m thick. Small-scale thinning-upward cycles within this mega-sequence suggest localized channel migration and abandonment. The measured orientations of flute casts indicate that paleocurrents radiated toward the west and southwest, apparently at a high angle to the continental margin.

Together, these data suggest that sediments exposed in the Garberville area were probably deposited within continental slope and restricted basin settings. If the general model associating the Franciscan complex with a Mesozoic-Cenozoic trench wedge is followed, then these strata can be interpreted as sediments deposited on the trench slope and within small trench slope basins above the deformed "accretionary prism" represented by much of the rest of the Franciscan.

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Effect of Sea Level Change on Shelf-Slope Boundary

Eustatic sea level changes cause alternating periods of subaerial exposure, flooding, or progradation at the shelf-slope boundary. Eustatic falls of sea level that are more rapid than subsidence cause subaerial exposure and canyon cutting. Rises of eustatic sea level coupled with subsidence commonly cause flooding of the shelf margin, marine transgression, and sediment starvation of the middle and outer shelf. Stillstands or slow falls of eustatic sea level that are less than the rate of subsidence commonly cause marine regressions where, in many places, the shoreline progrades out to the shelf-slope boundary.

The effect of eustatic sea level changes on the shelf-slope boundary is readily observable on seismic data despite changes in the rate of subsidence and rate and type of deposition. Seismic and well data from offshore northwest Africa are used to demonstrate these relations. In this area, high subsidence rates followed the opening of the Atlantic in the Early Jurassic and gradually changed to very slow subsidence rates in the Tertiary. Depositional rates increased throughout the Jurassic, reaching a maximum in the Early Cretaceous. Rates of deposition were very low in the Late Cretaceous and Early Tertiarty and increased again in the late Tertiary. Sediment type changed from primarily carbonate in the Jurassic to sands, silts, and shales in the Cretaceous and Tertiary.

This and other examples demonstrate that sea level change is the major factor affecting the shelf-slope boundary in different tectonic settings. The only known cause for the high rates of sea level change determined in these studies is glaciation. Such studies indicate major phases of glaciation occurred periodically throughout the Phanerozoic. Timing of possible glacial periods is shown for the Jurassic and Tertiary.

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Cause of Northern North Sea Jurassic Unconformities

Thirteen unconformities and their correlative conformities (sequence boundaries) divide the strata of the Jurassic of the northern North Sea into twelve cycles of coastal onlap. Comparison of charts showing regional relative change of coastal onlap, unconformity age, stratal patterns, and facies relations from the northern North Sea with global charts of relative changes of coastal onlap and eustatic sea level indicates that the unconformities are global and are caused by eustatic changes of sea level. Nine of the global unconformities are believed to be caused by rapid eustatic falls of sea level, three by slow falls followed by rapid rises, and one by an increased rate of sea level fall. In addition, four marine hiatuses were identified that are interpreted to be related to rapid rises of sea level.

Fault block rotation or differential block subsidence occurred almost continuously throughout the Jurassic, causing tilting of beds. Unconformity recognition is enhanced by periodic truncation of tilted strata by lowstand erosion and/or onlap during the subsequent rises, but the tectonics do not cause the unconformities.

Northern North Sea unconformities and coastal onlap are demonstrated on two seismic sections tied to well control. One section is from the United Kingdom part of the north Viking graben; the second is from the inner Moray Firth. Sequence boundaries and charts showing chronostratigraphy, relative change of coastal onlap, and ages of unconformities are shown for each seismic section.

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