lineage with pyriform thecas have flat to convex ambulacra from the late Meramec to the early Chester; nearly flat or concave ambulacra occur in middle and late Chester specimens. The number of hydrospire folds per hydrospire group is four to five in early Chester pyriform species; five to seven in the middle Chester, and four to five in some late Chester forms.

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Late Cretaceous Biostratigraphy in Los Baños Creek Area, California

Facies studies present a narrowing of the continental shelf during the Cretaceous-Paleocene transition in central California. Response to this changing environment was attended by accelerated evolution and proliferation of individuals prior to the extinction of many previous well adapted animal stocks, especially the ammonoids and the larger reptiles.

Evidence is lacking for the presumed unconformity between the Cretaceous and Tertiary sediments, and the often quoted Paleocene transgression is actually more regressive in character, with a considerable increase in red oxidized sandstones and associated tidal marsh leaf-bearing clastics.

The Late Cretaceous stratigraphic nomenclature is compromised with the increasingly continental trend of the Late Cretaceous deposits north of Los Baños Creek. For example, the Volta Member of the Garzas Formation northward grades from the medium-depth neritic foraminiferal marl of the Marca shale through the littoral calcareous sandstones of the "Mercy" Sandstone lentil to the brackish-water anauxitic sandstone member of the lower "Martinez" Formation.

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Permian Fusulinids in Eastern Nevada—Paleoecologic Implications

Field and laboratory studies of fusulinids from exposed Permian strata in no fewer than 15 mountain ranges in eastern Nevada, and six similar sections in western Utah have progressed to the point that the following conclusions can be drawn concerning paleoecology of these Foraminifera: (1) they were most abundant in the infraneritic to epineritic benthos; (2) areas of optima were below wave-base for many schwagerinids, although some of these along with numerous parafusulinids seemingly thrived in areas of high energy; (3) most species of all fusulinids occur in areas where clean calcarenitic limestones and clean carbonate muds accumulated; (4) pseudoschwagerinids and paraschwagerinids lived in environments of agitation as well as under circumstances of slightly foul bottoms; (5) triticitids and pseudofusulinids occurred where silty, sandy, and calcarenitic materials were accumulating under moderate- to high-energy conditions; (6) most species of fusulinids can be found in the reef-tract; some in fact contributed notably to this biotope.

Throughout most places in eastern Nevada (and western Utah) strata of Wolfcampian age are limestones of criquinitic, calcarenitic, and high-energy patch-reef types. These contain pseudofusulinellids, schwagerinids, and pseudoschwagerinids in abundance. Strata of Leonardian age consist of silty, sandy, calcarenitic and reef materials, all more or less rich in robust to elongated schwagerinids and parafusulinids; pseudoschwagerinids occur abundantly in reef-rocks. Strata of late Leonardian, and Wordian to early Capitanian age locally are gritty, sandy, conglomeratic, and coarsely bioclastic; diagnostic species of parafusulinids and schwagerinids preferred the environment typifying these sedimentary realms.

It should be emphasized that possibly all these Foraminifera at times and under optimum environmental conditions formed veritable slimes and oozes of protoplasm. Some of this material may have contributed to oil source beds for strong hydrocarbon odors now characterize most fusulinid-bearing strata of the Permian of eastern Nevada and western Utah.

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Late Devonian—Early Mississippian Correlations Central Wasatch Mountains, Utah

Strata of Late Devonian age have been recognized west of the Wasatch Front (Pinyon Peak Limestone and "City Creek Limestone") and a few miles east of the Wasatch Mountains in the western Uinta Mountains (Pinyon Peak Limestone?). These consist commonly of a basal sandstone or shale a few feet thick which grades upward to a dolomite sequence that ranges in thickness from 50 to 300 feet. This succession is in turn overlain by the Madison Limestone (Mississippian). On the west this contact is conformable but on the east it is unconformable. In the Wasatch Mountains, sandstone or shale a few feet thick rests on older rocks (mostly of Cambrian age) and changes upward through about a 3-foot interval into medium to dark gray dolomite about 50-150 feet thick, which in turn is overlain conformably by the Madison Limestone. These pre-Madison rocks were tentatively correlated with the Jefferson Formation (Devonian) by earlier workers on the basis of stratigraphic position and lithologic character. Subsequent workers of the U. S. Geological Survey have reported corals of Mississippian affinity from the exposures in American Fork Canyon and have thus assigned a Mississippian age to these strata.

Restudy of several of the Wasatch Front exposures disclosed well preserved molds of the brachiopod *Cyrtospirifer whitneyi* (?) in the basal sandstone in the Big Cottonwood Canyon area. This fossil is generally considered to be of Late Devonian age and has been collected from the Pinyon Peak Limestone in the western Uintas and in the areas west of the Wasatch. Thus the Mississippian age assigned to these rocks on the basis of corals is questionable. Moreover, a Late Devonian age is more consistent with a regional stratigraphic correlation on the basis of physical evidence. Therefore the "Jefferson (?)" of the Wasatch is here correlated with the Pinyon Peak Limestone of the areas east and west.

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The Exploration Team

Advancements in petroleum technology during the past 40 years have been so extensive that the science of finding oil has rendered obsolete dependence on one man or one method. Exploration success must now rely on the close cooperation of many people and utilization of all applicable methods.

Since the surface and seismic refraction programs of the 1920s and 1930s, new and highly specialized tools have contributed substantially to the complexity of the oil explorer's task in the 1960s.

It is no longer sufficient for the geologist, as the anchor man on the exploration team, to be knowledgeable only in his own specialty. Conversely, he should recognize that he can not be all things to all people. It is his personal challenge, as well as that of the increasing number of specialists with whom he comes in contact, to make skillful use of team effort.

Modern oil exploration has become a process in which no two situations are alike. The diversity of plays demands the close cooperation of the geologist, geophysicist, and researcher with landmen, economists, and producing specialists in establishing optimum programs.

Overlaid on these responsibilities is the need for greater awareness of the political, educational, public, and community relations, considerations which have come to have an increasing importance in the conduct of exploration team activities. Such influences frequently affect strategy, tools, timing, and logistics, as well as land and legal procedures.

Still another area of responsibility for the team member lies in the development of improved communications. The obligation to share geological or geophysical data collected at all points within an organization's sphere of operations is an immediate necessity. Geological experience gained in one corner of the world may result in unsuspected benefit to operations in an entirely separate area.

Building and maintaining a team with the necessary skills and imagination capable of meeting and moving beyond contemporary requirements have thrust some new and specific responsibilities on the industry itself.

Intense competition and a soft price structure in foreign oil markets have sharpened the need for unprecedented efficiency in Free World oil circles. The oil explorer is no longer the glamor-boy of the industry, aloof from the economics of marketing and manufacturing. He must accept the role of a team member for his own survival in an era of vastly increased world-wide competition.

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Spore-Pollen Correlation of Cretaceous Rocks of Northern and Southern Hemispheres

This paper summarizes published and unpublished palynological data from Upper Jurassic and Cretaceous sediments of northwest Europe, Russia, North and Central America, the Middle East, North and West Africa, South America, Australia, and New Zealand. Many publications could be considered only in a very general way or had to be disregarded because of the inadequate illustrations and descriptions of species and nomenclatural confusion or because of the complete lack of stratigraphic data.

Numerous very distinctive forms of spores and pollen grains, some of which can be assigned with confidence to living families of plants, make their first appearance in the fossil record during Upper Jurassic and Cretaceous time. They are accompanied in the marine sediments by the incoming of equally distinctive forms of microplankton. Based mainly on the incoming of such forms of spores, pollen, and microplankton, many authors have erected varying numbers of palynological subdivisions for use purely in local correlation in their respective areas. Some, but unfortunately few, by comparison with spores, pollen, and microplankton from sections independently dated by other fossils such as ammonites or foraminifera, have attempted to correlate local palynological subdivisions with the standard biostratigraphic units of the Cretaceous.

A compilation of results from published works, together with unpublished results from Royal Dutch/Shell Group palynologists, suggests the following generalized sequence of spore and pollen floras and their approximate correlation with the standard biostratigraphic units.

Upper Cretaceous.—Floras with increasing numbers of species of dicotyledonous pollen grains. Tendency toward typical Northern and Southern Hemisphere floras is apparent in the Lower Senonian and is clearly marked by the Upper Senonian. In most areas considered, a broad 3-fold palynological subdivision is apparent, which is correlated generally with the Cenomanian-Turonian, Lower Senonian, and Upper Senonian.

Aptian-Albian.—First appearance of generally small and more or less sculptureless tricolpate dicotyledonous pollen grains in both Hemispheres. Last appearance in most areas of the Northern Hemisphere of such typical Jurassic-Lower Cretaceous forms as *Classopollis torosus, Caytonipollenites pallidus, Pilosisporites trichopapillosus.*

Hauterivian - Barremian. — Northern Hemisphere floras generally characterized by co-occurrence of Jurassic and older Cretaceous forms of spores and pollen together with *Ephedra*-like pollen and rare monosulcate pollen grains with clearly differentiated exine (*Clavatipollenites*).

Not sufficient data from Southern Hemisphere for comparison.

Valanginian.—In both Northern and Southern Hemispheres generally characterized by abundant specimens of *Cicatricosisporites dorogensis* and related forms together with abundant typical Jurassic gymnosperm and pteridosperm pollen. Clearly separated from Jurassic in Northern Hemisphere by first appearance of a number of forms including *Appendicisporites.*

The paleontological and stratigraphic evidence used in the correlation of local palynological subdivisions with the biostratigraphic units within the areas considered, is summarized in the form of range charts, and some of the more distinctive species of spores and pollen are illustrated by photomicrographs.

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Plant Microfossils and Geology

The role of palynology in the exploration for oil is essentially comparable with that of any other branch of paleontology. Advantages and limitations of sporomorphs, algae, miscellaneous protistans of uncertain affinity, and other similar-sized microfossils utilized in palynology as stratigraphic and paleoecologic indicators are briefly reviewed. The economic value of this relatively modern scientific field to the petroleum industry may be increased and hastened by avoiding some of the pitfalls which befell micropaleontology in its earlier years of application. Information should be developed simultaneously on the biology, ecology, and stratigraphy of these organisms.

Palynologists now being trained should be encouraged to develop their knowledge of both geologic and biologic fundamentals. Research should be sponsored in industry research laboratories and in private or university laboratories—research which includes studies of the distribution and preservation of sporomorphs in modern sediments; relative significance of living assemblages to other types of organisms; development of methods and programs for mechanical classification of these microfossils and analysis of data; improvement of techniques for separating spores and similar fossils from