

deposits: Asphalt Ridge, Hill Creek, PR Springs, and Sunny-side. In central-southeast Utah, 21 deposits contain between 10 and 15 billion bbl, a less precise estimate because of the lack of definitive subsurface data. About 90 % of this is contained in 3 giant deposits. Elsewhere in Utah 4 less important deposits are found.

A wide variety of crude oils in varying stages of preservation and alteration has been analyzed. Gravities (API) range from minus values to near 15°; range in deposits considered of commercial interest is 8 to 15°. Uinta basin deposits of Tertiary age contain oil with an average sulfur content around 0.4 %. Permian and Triassic deposits in central-southeast Utah yield oils with between 3.0 and 4.3 sulfur.

Two types of deposits are recognized: *in situ* (oil fields in their original position breached by erosion) and migrated (oil displaced from a ruptured trap to another position). Most southern Uinta basin and central-southeast Utah deposits are *in situ*; northern Uinta basin deposits appear to be migrated; actually they are seeps disseminated on the outcrop.

The deposits exist in a wide variety of physical situations, and reservoirs tend to be heterogeneous. Mining appears to be the most likely method of large-scale exploitation. Serious legal, political, environmental, and technologic problems exist. Growing scarcity of energy and petrochemical sources is creating an economic climate in which development is feasible.

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 CHARACTER DISPLACEMENT IN CAMBRIAN AGNOSTID TRILOBITES

The phenomenon known as *character displacement* develops when the ranges of 2 or more closely related species overlap geographically. Differences between the species are accentuated in the zone of sympatry, but remain less pronounced in the parts of their ranges outside that zone. Characters displaced may be morphologic, ecologic, behavioral, or physiologic. Biologists have shown that size is one of the most common morphologic characters displaced. A moderate difference in size—on the order of 1.3—appears to be sufficient to cause obligated feeding on different kinds of food, and thus permits sympatric species to avoid competitive elimination.

Although character displacement in modern faunas has been well documented, to my knowledge no examples have been described from the fossil record. Analysis of several extensive collections of Cambrian fossils suggests that size displacement was common among agnostid trilobites. Where 2 or more agnostid trilobites are found together, the interspecific ratio of maximum size usually is close to 1.3. Also, maximum size generally is more uniform where given species are separated than where they are found together. The similarity of these patterns to those displayed by certain modern faunas indicates that sympatric agnostids were structurally specialized to feed on resources of different sizes. This conclusion helps to explain how superficially similar species of Cambrian agnostids may have coexisted without competitive elimination. The examples further indicate that character displacement was operating early in the history of metazoans.

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LATE CRETACEOUS AND EARLY TERTIARY STRATIGRAPHY AND PALYNOLOGY, HOBACK RIVER BASIN, WESTERN WYOMING

Pollen samples collected in the Hoback River basin yield

Eocene, Paleocene, and Late Cretaceous dates. These dates, especially the Late Cretaceous ones, have helped redefine the stratigraphy in this area. Previously mapped Paleocene parts of the Hoback Formation can now be assigned to Upper Cretaceous Harebell Formation, Mesaverde Formation, and lenticular sandstone and shale sequence.

The pollen data also confirm structural reinterpretations. Previous maps show an anticlinal fold in the Hoback Formation, which parallels the Cliff Creek thrust. The Game Hill fault has been mapped, and places Cretaceous rocks against a middle Paleocene slice of the Hoback Formation. This slice lies between the Cliff Creek thrust and Game Hill fault. Evidence suggests the Game Hill fault predates the Cliff Creek thrust.

In addition to aiding structural and stratigraphic refinements in this area, the pollen samples allow comparison between early Tertiary invertebrate, vertebrate, and palynologic dates derived from identical sites.

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FOSSILIFEROUS CONCRETIONS—POSSIBLE EVIDENCE OF PURPOSEFUL FOOD GATHERING

Concretions containing many, closely packed fossils are sufficiently numerous to warrant special attention and probably a distinctive designation. A few examples emphasize the problem of origin: (a) one concretion from shale above the no. 5 coal bed of Illinois (Pennsylvanian) yielded at least 1,000 uncrushed *Composita argentea*; the sparse fauna of the matrix is extensively crushed; (b) 3 concretions from the Deseret Limestone (Mississippian) of north-central Utah yielded several hundred specimens of the ammonoid *Dzhaprakoceras* known previously only from Asia; (c) one concretion from the Colorado shale (Early Cretaceous) near Harlowton, Montana, yielded 1,400 uncrushed specimens of the ammonite *Gastrolites*, a relatively rare genus in North America, (d) numerous concretions from the Ferron Sandstone (early Late Cretaceous), Emery County, Utah, under investigation by the writers, have a well-preserved molluscan fauna, whereas the matrix is practically unfossiliferous; and (e) very abundant concretions in the Fox Hills Formation (late Late Cretaceous) of South Dakota commonly show dense accumulations of several molluscan species; fossils are otherwise sparse.

It is proposed that such fossiliferous concretions have resulted from selective, purposeful, food-gathering or hoarding activities of large vertebrate or invertebrate marine animals. No other agency seems capable of bringing together large numbers of sessile, somewhat heavy, and probably still-living animals into small compact masses. Whether these represent food not yet ingested, undigestible residues (coprolites?), or contents of some part of the alimentary canal in process of digestion is not known. The term "gastric concretion" is proposed as sufficiently broad and descriptive to cover this type of accumulation.

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GEOLOGICAL MALPRACTICE, AN APPROACHING THREAT

Geologists' studies of environment of deposition are increasingly subject to scrutiny by those who are not professionally knowledgeable in the subject. The study becomes one related to the phrase "to depose" and the environment becomes the legal context of malpractice litigation, the scrutiny by lawyers. Until very recent years, professional earth scientists were well insu-