suitable for forming reservoir rock during the time that deep circulation has been an important process in the western North Atlantic. This process is thought to have begun about 50 m.y.B.P. There would be deposition only of fine-grained, relatively impermeable, potential source beds.

It is concluded that Cenozoic sediments of the continental rise, at least off the east coast of North America, may not be a likely source for future hydrocarbon recovery. A few deep holes into the continental rise (preceded by complete seismic surveys) are needed to assess the potential of the underlying, deeply buried Paleozoic section.

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Sonobuoy Refraction Measurements from Norton Basin, Northern Bering Sea

Recent discovery of thermogenic gaseous hydrocarbons seeping from the seafloor 45 km south of Nome, Alaska, suggests that the underlying Norton basin may be an important future petroleum province. The results of 38 sonobuoy refraction profiles obtained in 1977 and 1978 show that Norton Sound and Chirikov basin are underlain by a single sedimentary trough approximately 130 km wide and 350 km long; the basin axis trends west-northwest and extends from Stuart Island to a point 100 km west-southwest of King Island. Although average depth to basement is only 2.5 km, two deeper areas, containing up to 5.5 km of sedimentary section, were discovered 75 to 90 km northwest of the Yukon River delta.

Norton basin is floored by an acoustic basement whose compressional velocity is 5.5 to 6.5 km/sec. The basin fill consists of three major units distinguishable on the basis of their compressional velocities; unconformities probably separate each of these units. The basal unit, with a velocity of 4.9 km/sec, is present only in the deeper parts of the basin. A thick (2 to 3 km) section has velocities ranging from 2.3 to 3.7 km/sec and lies on this lower unit and on acoustic basement. Compressional velocities in the 1.2 km-thick upper unit range from 1.6 to 2.1 km/sec. The lower two units are probably Cretaceous and lower to middle Tertiary marine and nonmarine rocks lying on a basement complex of Paleozoic and Mesozoic igneous, metamorphic, and sedimentary rocks similar to those mapped on Seward Peninsula and St. Lawrence Island. The upper unit probably consists of upper Tertiary and Quaternary sedimentary rocks and sediment.

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Microfossils, Macrofossils, and Stromatolites from Middle Proterozoic Belt Supergroup, Montana

Essentially unmetamorphosed strata exposed in the eastern part of the Beltian basin contain a wide variety of middle Proterozoic fossils and stromatolites.

Organically preserved microfossils are abundant in shales of the Chamberlain Shale and Newland Limestone (ca. 1,400 m.y.) in the Little Belt Mountains. This assemblage includes tubular filaments which appear to represent mainly the preserved sheaths of *Lyngbya*-like oscillatoriacean cyanophytes and sphaeromorphs which might in turn represent the preserved outer sheaths of colonial coccoid cyanophytes or possibly the encystment stages of eukaryotic algae. The sphaeromorphs include forms (e.g., *Kildinella* sp.) which are potentially useful for intercontinental biostratigraphic correlation.

Tabular microstructures defined by hematite particles and probably representing outlines of sheaths of oscillatoriacean cyanophytes in calcareous stromatolites of the Snowslip Formation (ca. 1,100 m.y.) in Glacier National Park represent one of the few occurrences of Proterozoic microfossils preserved within wholly calcareous rocks. Microfossils also occur in association with syngenetic sulfides in shales of the Appekunny Argillite (ca. 1,300 m.y.) in Glacier National Park.

Macroscopic carbonaceous compressions occur in shales of the Newland Limestone (ca. 1,400 m.y.) in the Little Belt Mountains and probably represent macroscopic, and possibly eukaryotic, algae.

Stromatolites are particularly abundant, diverse, and well exposed in strata ranging from 1,400 to 1,100 m.y. old in Glacier National Park. In addition to having paleoenvironmental significance, inclined conical stromatolites provide paleocurrent information useful in basin analysis, and branched columnar forms are potentially useful time-stratigraphic indicators.

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Pool Depletion and Geochemical Signal Decay

No abstract available.

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Effect of Depletion on Near-Surface Hydrocarbon Anomalies

Early in the history of geochemical prospecting, it was recognized that more intense soil-hydrocarbon anomalies occur in the near-surface soil over newly discovered petroleum accumulations than over those that are depleted or nearing depletion. The first convincing confirmation of this effect was obtained in 1968 after resurveying the Hastings oil field, Brazoria County, Texas, which previously was sampled in 1946. The outstanding soil hydrocarbon anomaly of the earlier survey did not reappear in the 1968 study.

Surveys conducted in 1970-71 over new and old oil and gas producing areas in Jackson County, Texas, furnished additional support to the thesis that removal of hydrocarbons from subsurface reservoirs affects near-surface soil hydrocarbon anomalies.

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Sedimentary Structures of "High-Energy" Beach-to-Offshore Sequence, Ventura–Port Hueneme Area, California