part of the Iditarod quadrangle. The ultramafic rocks are poorly exposed on rounded tops of the low rolling hills in the area, and they form a northeast-southwest belt at least 8 mi long and as much as 3 mi wide. Although these rocks are associated with Mississippian to Jurassic(?) chert, tuff, argillite, and basalt of the Innoko terrane, the contact relations are uncertain.

The ultramafic rocks consist of harzburgite, lherzolite, pyroxenite, and pods of altered dunite; disseminated chrome spinel is a common but minor constituent. Serpentinization is ubiquitous, all samples showing at least some effects and many being entirely serpentinized. Discontinuous pods of former serpentinized dunite(?) within lherzolite are entirely altered to a magnesite + talc + chrome spinel assemblage, indicative of low-grade metamorphism in the presence of water and carbon dioxide.

The ultramafic rocks of Iditarod quadrangle are similar to and on trend with those of the Mount Hurst area, 25 mi to the northeast in the Ophir quadrangle. The Mount Hurst rocks represent part of a dismembered ophiolite, probably related to the Yukon-Koyukuk ophiolite belt. Although several of the classic ophiolite components are missing from the ultramafic sequence in Iditarod quadrangle, an ophiolite origin is strongly suggested by correlation with the Mount Hurst rocks and is supported by the presence of a structural slice of hypersthene gabbro in close proximity to the ultramafic sequence.

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Late Cretaceous Coccolith Biostratigraphy of San Miguel Island, California

Coccoliths recovered at 69 localities from the northwest coast of San Miguel Island provide definitive biostratigraphic criteria for subdivision of more than 1,425 m of submarine fan strata of the Mirounga formation of Late Cretaceous age. The seven coccolith zones recognized from the stratigraphic distribution of 38 species suggest that San Miguel Island has one of the most complete sequences of Upper Cretaceous strata in southern California. The zones are, from oldest to youngest: *Quadrum gartneri, Eiffellithus eximius, Marthasterites furcatus, Micula staurophora, Broinsonia parca, Quadrum trifidum,* and *Arkhangelskiella cymbiformis* zones. These coccolith zones are known elsewhere in the world. They appear to represent a time interval from the early Turonian to the middle Maestrichtian, although coccolith criteria for the Santonian stage interval were not observed, possibly because of ecological restrictions.

Coccolith localities along the northwest coast of San Miguel Island indicate Upper Cretaceous strata where the Paleogene Pozo-Canada Formations and South Point sandstone had been mapped previously. These new data may add more than 500 m of rock to the previously recognized Late Cretaceous stratigraphic column. On the basis of coccolith criteria, various parts of the Mirounga formation correlate with Upper Cretaceous rocks of the southern California mainland such as: the Jalama Formation (western Santa Ynez Mountains), the Chatsworth Formation (Simi Hills), the Holz Shale Member of the Ladd Formation (Santa Ana Mountains), and the Point Loma Formation of the Rosario Group (San Diego area). Correlations are possible also with the Valle Formation of Mexico (Vizcaino Peninsula).

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Depositional History and Seismic Stratigraphy of Lower Cretaceous Rocks, National Petroleum Reserve, Alaska and Adjacent Areas

Knowledge of depositional history of Lower Cretaceous rocks in the National Petroleum Reserve in Alaska is necessary for predicting the occurrence of potential sandstone reservoirs. These rocks range in thickness from 7,000+ m along the Colville basin axis to about 1,200 m on the Barrow arch. Lower Neocomian strata on the north flank of the basin consist of southward-prograding marine shelf and slope deposits of shale and minor sandstone units. Uplift, erosion, and subsequent transgression on the northernmost flank of the basin resulted in deposition of the pebble shale unit in late Neocomian time and termination of the northern provenance. Following this, the basin was downwarped, and little deposition occurred on the north flank until distal, deep-water deposits of the Torok Formation onlapped and downlapped the south-dipping flank of the basin in middle or late Albian time.

On the south flank of the basin, southern-source turbidites of the Okpikruak Formation (early Neocomian) accumulated in a subsiding foredeep and were subsequently thrust northward in late Neocomian or Aptian time. The Fortress Mountain Formation (early Albian), which consists of as much as 3,000 m of mainly deep-water deposits, unconformably overlies the Okpikruak and older rocks on the southernmost flank of the basin. Filling of the Colville basin occurred in middle to late Albian time as thick prodeltaic and deltaic deposits of the Torok Formation and Nanushuk Group, respectively, prograded across the basin from the south on the south side of the basin, but prograded principally from the west-southwest over most of the basin.

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Significant Outcrops of Cretaceous and Tertiary Rocks in Northeastern Alaska

Cretaceous and Tertiary rocks in northeastern Alaska comprise the Neocomian part of the northerly derived Ellesmerian depositional sequence and the overlying Brookian sequence, which was derived from the ancestral Brooks Range to the south and southwest. The Ellesmerian part is less than a few hundred meters thick and consists of the upper part of the Kingak Shale and the overlying transgressive part of the pebble-shale unit and associated Kemik Sandstone Member of the Kongakut Formation. The Brookian sequence is more than 4,000 m thick and consists of, in ascending order: (1) a deep-water condensed section of organic-rich shale and bentonite with a discrete 30 to 60-m thick radioactive zone at the base; (2) a slope-and-shelf shale section with turbidites at the base; (3) a fluvial-dominated deltaic sequence that, except for one major and several minor transgressions, prograded from southwest to northeast during Albian to Eocene time; and (4) a shallow marine and nonmarine post-Eocene section.

Rocks of the four facies, which represent a wide range of depositional environments, are discontinuously exposed along the coastal plain and foothills of the Brooks Range in northeastern Alaska. Certain outcrops are significant because they show critical facies relationships. Recognition of vertical and lateral facies sequences and key lithologic units, in conjunction with available paleontologic data, facilitates correlation of the Cretaceous and Tertiary rocks both across the outcrop belt and into the subsurface to the north.

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Pre-Mississippian Accreted Terranes of Northeastern Brooks Range, Alaska

Low-grade metamorphic rocks (Neruokpuk Formation, sensu lato) underlying a regional angular unconformity in the northeastern Brooks Range have been interpreted as a conformable Precambrian to Devonian stratigraphic succession. The pre-Mississippian rocks include not only "miogeoclinal" quartzites and carbonates but also a variety of "eugeoclinal" lithologies such as radiolarian cherts, argillites, and graptolitic shales; mafic to intermediate volcanic rocks; and volcanogenic graywackes. Fossils of Cambrian, Ordovician, and Silurian age have been identified in these lithologies. Many of these units are fault-bounded and may be interpreted as pre-Mississippian tectono-stratigraphic terranes. Several of the terranes are depositionally overlapped by Middle(?) Devonian clastic rocks and intruded by plutonic rocks depositionally overlain by Mississippian and younger rocks, but which yield equivocal middle Paleozoic age dates. Similar relationships are exposed in the Doonersk anticlinorium in the central Brooks Range. These features are interpreted to indicate that the lower Paleozoic rocks of the eastern Brooks Range were tectonically assembled by accretionary processes along an active continental margin prior to Middle Devonian time. Subsequent uplift and erosion occurred prior to deposition of the Mississippian to Neocomian (Ellesmerian) passive margin sequence.

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Stratigraphy and Sedimentology of Kuskokwim Group in Vicinity of Cairn Mountain, Southwestern Alaska