In Pragian time, crinoid thickets were extensive across the platform. By Emsian time, an east-west-trending rugosan coral-stromatoporoid reef complex, cored by *Renalcis*-bound mudstone, had developed along the platform margin. This reef complex was composed of large colonial corals, often capped by stromatoporoids, with framework cavities filled with skeletal wackestone to rudstone matrix. A pelletal and intraclastic wackestone to packstone facies was deposited in the slightly protected back-reef environment to the north. Concurrently, sediments and blocks were shed from the fore reef southward into the foreslope environment dominated by a *Thamnopora*-crinoid floatstone to rudstone facies. Slope failures produced bioclastic debris flow and turbidite sedimentation of shelf-carbonate detritus into the coeval shale of the adjacent basin situated to the south and west. Pelagic sedimentation of clay-size carbonate material also deposited thin, dark, lime mudstone beds within this basin.

Toward the end of Emsian time, a rapid marine transgression inundated the shallow shelf area, and deeper water open marine carbonate sedimentation occurred, represented by a tentaculitid-rich whole-fossil bioclastic wackestone to mudstone facies. As the waters continued to deepen, basinal siliceous oozes and clays were deposited over the entire region through the Middle Devonian.

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Shelf to Basin Transition of Silurian-Devonian Rocks, Porcupine River Area, East-Central Alaska

Exposures of Silurian to lowermost Devonian strata in the Porcupine River region consist of an unnamed carbonate unit and the Road River Formation. Petrographic studies indicate that these rocks display facies representative of five depositional environments: basin, open sea shelf, deep shelf margin, open platform, and restricted shelf.

The unnamed carbonate unit, exposed in the Linear Ridge area, is 390 ft (126 m) thick and records a history of restricted shelf to basinal sedimentation. Stratigraphic relations and paleontological studies suggest a Middle to Late Silurian (Ludlovian) age for this unit.

The Road River Formation is Late Silurian (Ludlovian) to Early Devonian (Lochkovian) in age and is exposed near the confluence of the Porcupine-Salmontrout Rivers and downstream along the Lower Ramparts. It consists of 30-190 ft (10-61 m) of graptolitic shale with interbeds of siliceous limestone. Petrographic studies of the shales are interpreted to reflect deposition in a basinal setting, whereas the siliceous limestones represent deep shelf-margin debris flows derived from nearby, coeval shallow-water shelf environments. Together, the unnamed carbonate unit and the Road River Formation represent a shelf to basin transition on a carbonate ramp that transcends the Silurian-Devonian boundary.

Petrographic examination of these rocks reveals that they are susceptible to a wide range of diagenetic processes, including (1) micritization, (2) neomorphism, (3) syntaxial overgrowths, (4) pressure solution (stylolitization), (5) trapping of dried hydrocarbons, (6) tensional stress (calcite veining), and (7) silicification.

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Cretaceous and Tertiary (Brookian) Depositional Style on Barrow Arch, North Slope, Alaska

Throughout Cretaceous and Tertiary time on the North Slope, clastic debris was shed northward from the rising ancestral Brooks Range to fill the adjacent foredeep and to prograde northeasterly across the subsiding Barrow arch to form a passive margin sequence. Study of these southern source sedimentary rocks, known as the Brookian sequence, in wells and on seismic records along the Barrow arch in the National Petroleum Reserve in Alaska (NPRA) and only in wells east of NPRA shows a consistent style of deposition. This style is characterized on seismic reflection records by a distinct topset-foreset-bottomset profile that is inferred to represent a time line and thus a depositional profile.

Topset reflectors coincide with deltaic and shelf deposits. Near the "shelf break," the boundary between topset and foreset reflectors, the distal topset and foreset reflectors coincide with fine-grained marine siltstone and mudstone. Bottomset reflectors coincide with interbedded turbidite sandstone and marine shale near the base of the "slope." Away from the base of the slope, bottomset deposits become progressively thinner and are composed primarily of organic-rich shale.

Cretaceous and Tertiary rocks along the Barrow arch record several significant transgressions and regressions. The last stages of deposition of the Ellesmerian sequence and drowning of the remnant of the northern land mass is represented by an upper Neocomian transgressive marine sandstone grading upward into marine shale. The boundary between Ellesmerian (northern source) and Brookian (southern source) sequences lies within a distal, condensed, high gamma-ray-reading shale (the gamma-ray zone or HRZ). Subsequent progradation from the southwest to the northeast deposited the characteristic passive margin sequence. This prograding sequence has been interrupted by a minimum of three marine transgressions: once during the Cenomanian, again in the Campanian, and most recently during the Eocene. The onshore North Slope record from Oligocene to Pleistocene is all deltaic topset deposition, which presently cannot be resolved into any additional transgressions.

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Crustal Structure of Bristol Bay Region, Alaska

Bristol Bay lies along the northern side of the Alaska Peninsula and extends nearly 600 km southwest from the Nushagak lowlands on the Alaska mainland to near Unimak Island. The bay is underlain by a sediment-filled crustal downwarp known as the north Aleutian basin (formerly Bristol basin) that dips southeast toward the Alaska Peninsula and is filled with more than 6 km of strata, dominantly of Cenozoic age. The thickest parts of the basin lie just north of the Alaska Peninsula and, near Port Mollar, are in fault contact with older Mesozoic sedimentary rocks. These Mesozoic rocks form the southern structural boundary of the basin and extend as an arcuate belt from at least Cook Inlet to Zhemchug Canyon (central Beringian margin).

Offshore multichannel seismic-reflection, sonobuoy seismic-refraction, gravity, and magnetic data collected by the USGS in 1976 and 1982 indicate that the bedrock beneath the central and northern parts of the basin comprises layered, high-velocity, and highly magnetic rocks that are locally deformed. The deep bedrock horizons may be Mesozoic(?) sedimentary units that are underlain by igneous or metamorphic rocks and may correlate with similar rocks of mainland western Alaska and the Alaska Peninsula. Regional structural and geophysical trends for these deep horizons change from northeast-southwest to northwest-southeast beneath the inner Bering shelf and may indicate a major crustal suture along the northern basin edge.

Bedrock and crystalline rocks beneath the Bristol Bay basin may be part of the extensive peninsular terrane that is believed to have accreted to southern Alaska in late Mesozoic or early Tertiary time. Development of the basin by extensional subsidence of Mesozoic basement rocks and infilling by a Cenozoic sedimentary section probably initiated in earliest Tertiary time. Subsidence was probably most rapid in Oligocene and Miocene time, based on sediment thicknesses in the St. George basin COST 2 and Gulf Sandy River (Alaska Peninsula) wells.

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Geology of the Point Arguello Discovery

Chevron as operator for its partners, Phillips, Champlin, and Impkemix, discovered the Point Arguello oil field in 1981. The discovery well, the Chevron et al P-0316-1, was drilled in federal waters 8.5 mi (13.7 km) south of Point Arguello, California. Delineation drilling has confirmed the presence of a giant oil field with estimated reserves in excess of 300 million bbl of oil.

The oil field is located within a small depocenter at the southern edge of the offshore Santa Maria basin. This local depocenter may contain over 15,000 ft (4,750 m) of Neogene rocks. The Point Arguello accumulation is trapped in a large north-northwest-trending anticlinal complex. The main reservoir is in the middle and upper Miocene Monterey Formation composed of fractured cherts, porcellanites, siliceous mudstones, and dolostones. Calculated fracture permeabilities range up to 3 darcies. Crestal wells have indicated productivities, after acid, of approximately 6,000 BOPD.