Foreland Formation, were placed on production in September 1969. Significant gas reserves in shallower Tyonek Formation sandstone have only been used so far for platform power and gas lift. Development plans are currently being formulated for these reservoirs in response to the recent increasing demands for gas in Cook Inlet.

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Paleomagnetism, Paleolatitudes, and Magnetic Overprinting on the North Slope, Alaska

Several paleomagnetic studies have been made in Arctic Alaska, by industry, by the U.S. Geological Survey, and by the University of Alaska. In general, the results available to the public have been disappointing—most samples of pre-Cretaceous rocks give very steep magnetic inclinations with respect to present horizontal. This has been generally interpreted in terms of a Cretaceous overprinting event.

A study of the paleomagnetism of Cretaceous rocks from the North Slope shows that although the Cretaceous field was steeply inclined, it was not as steep as conventional paleogeographic reconstructions would indicate, and not as steep as the bulk of the apparently remagnetized older rocks. This finding leaves open the possibility that the steeper directions recorded by the older rocks are the result of regional tilt, or the result of a paleogeography that allowed an earlier, steeper remagnetizing field.

The shallower inclinations seen in the Cretaceous sediments of the Nanushuk Group (Albian-Cenomanian based on the fossil record with one K-Ar age of 100 Ma from an ash parting) give paleolatitudes of about 75°N. The predicted paleolatitude based on North American paleogeographic reconstructions is 80-85°N. Circumstantial evidence that the paleolatitude was shallower than 80-85°N comes from the enormous biogenic productivity needed to form the extensive coal deposits of the Nanushuk Group. Lower paleolatitudes also may be needed to explain the apparent existence of broad-leaved evergreens and the recently reported dinosaur tracks and skin imprints in the Nanushuk Group.

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Structural Features Controlling Emplacement of Gold-Bearing Quartz Veins in Port Wells Mining District, Prince William Sound, Alaska

Data collected in the Port Wells mining district confidently show that the present structural features developed in several stages. These stages were folding, intrusion, faulting, and emplacement of quartz veins. The oldest stage was folding and concomitant metamorphism of the Cretaceous Valdez Group flysch during accretion. The semilithified rocks were folded in at least two phases. An early phase (F1) resulted in a 50% shortening in a northwest-southeast direction; the second phase (F2) caused minor shortening in a northeast-southwest direction. The next stage involved the intrusion of Oligocene plutons (36 m.y.) that crosscut earlier structures. Fracturing and faulting of the plutons and flysch characterized the next stage. Initial faults and structures caused only minor right-lateral displacement. The fault and joint data show details of the time relationship between intrusion and deformation. Several generations of epigenic gold-bearing quartz veins were emplaced along these joint systems. Minor deformation continuing to the present caused some disruption of the veins.

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Tin Creek Zinc, Lead, and Silver Skarn Prospects, Farewell Mineral Belt, Alaska

Several zinc, lead, silver, and copper skarn and replacement bodies occur in a 500 km^2 area near Farewell, in the McGrath quadrangle, Alaska. Detailed examination of the skarns in upper Tin Creek, one of the major mineralized areas, indicates ore and gangue zoning, which inversely follows dike density.

Host rocks for skarns are mid-Paleozoic sedimentary rocks that are contact-metamorphosed, folded, faulted, and overlain and intruded by Tertiary igneous rocks. Skarns in the Tin Creek area are small (up to 3 m wide), discontinuous bodies of exoskarn found along dike contacts and as endoskarn in the dikes. Skarn also forms mantos in marble and irregular bodies along thrust and high-angle faults. Semimassive to massive sulfide mantos are present in calc-silicate hornfels. Many dikes do not have skarn along their contacts while others have skarn along only one margin, indicating that dikes and faults are only structural conduits for later metasomatic fluids.

Sulfide distribution and deposition are intimately associated with calc-silicate metasomatism. The skarn prospects are areally zoned, with garnet- (Ad_{12-100}) and chalcopyrite-dominant skarns proximal and pyroxene- (Hd_{15-86}) and sphalerite-dominant skarns distal to the center of most intense dike swarms. Sphalerite is preferentially associated with pyroxene, while chalcopyrite is preferentially associated with garnet. Metamorphic garnet and pyroxene are devoid of sulfides and have the lowest iron compositions. Early metasomatic garnet and pyroxene are generally richer in iron and are accompanied by minor sphalerite + chalcopyrite. Late metasomatic (main-stage) garnet and pyroxene contain the highest iron contents for these minerals and are extensively replaced by sphalerite + chalcopyrite. Main-stage skarns are locally retrograded to amphibole or epidote + quartz. These calc-silicates may be replaced by sphalerite + chalcopyrite, with galena locally abundant as veins in pyroxene-dominant skarns.

Zinc, lead, and silver ore potential at Tin Creek exists at distances greater than 2 km from the dike swarm center. Zinc, lead, and silver ore is preferentially associated with pyroxene-dominant skarns formed during the main stage of metasomatism.

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A Framework for North Slope Seminar II

This meeting focuses on a province with enormous potential for fuels and minerals. Oil reserves approach 10% of the total oil already produced in the rest of the country. Estimated coal resources could store a thousand times the 70-80 quads of energy the U.S. uses every year. Potential yields of silver, lead, and zinc range from 10 to 100% of the amounts produced domestically since the middle of the 19th century. Prospects for copper are also large.

The province is dominated by the east-trending Brooks Range, whose structures formed during the late Mesozoic Brookian orogeny and are now being shortened longitudinally. Flanking basins succeeded the uplift; the northern one is bounded by a passive continental margin. Early in the orogeny, a relatively thin early Paleozoic through Jurassic megasequence of clastic-wedge, carbonate, and siliceous sediments was telescoped into a fivefold stacking of allochthons and beneath allochthons of volcanic and mafic-ultramafic rocks. The greater than 500-km breadth of sialic crust that had underlain the allochthons disappeared. At about the same time, the Arctic Ocean basin replaced the northern provenance. A mid-Paleozoic sialic source area on the opposite margin of the megasequence disappeared by the end of the Carboniferous and near the beginning of siliceous deposition. Basement beneath the North Slope part of the megasequence was created when the Devonian Ellesmerian orogeny added to the crust the late Precambrian to early Paleozoic clastic, carbonate, and volcanic rocks of an older megasequence.

The northern successor basin accumulated large amounts of coal. Truncation and sealing of potential reservoir rocks on replacement of the northern landmass led to huge pools of hydrocarbons. Late Paleozoic rocks in the lowest allochthon host stratabound base-metal deposits. A narrow belt of reportedly Devonian shallow-seated felsic rocks contain deposits of copper.

John Maher foresaw the benefits that the first North Slope seminar has provided. That precedent and developments during the past 15 years promise similar benefits from this meeting.

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Tectonic Implications of Paleomagnetism of Paleogene Volcanic Rocks on the Alaska Peninsula

Paleontologic and paleomagnetic data demonstrate that the Alaska Peninsula lay far south of its present location relative to North America in the early Mesozoic. Paleomagnetic studies of Late Cretaceous–early Tertiary volcanic rocks inboard of the Alaska Peninsula indicate no major northward displacement. Outboard of the peninsular terrane,