with planar to cross-laminated quartz-carbonate metasandstone and phyllite.

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Metamorphic Facies Map of Alaska

A metamorphic-facies map of Alaska has been compiled, following the facies-determination scheme of the Working Group for the Cartography of the Metamorphic Belts of the World. Regionally metamorphosed rocks are divided into facies series where P/T gradients are known and into facies groups where only T is known. Metamorphic rock units also are defined by known or bracketed age(s) of metamorphism. Five regional maps have been prepared at a scale of 1:1,000,000; these maps will provide the basis for a final colored version of the map at a scale of 1:2,500,000. The maps are being prepared by the U.S. Geological Survey in cooperation with the Alaska Division of Geological and Geophysical Surveys.

Precambrian metamorphism has been documented on the Seward Peninsula, in the Baird Mountains and the northeastern Kuskokwim Mountains, and in southwestern Alaska. Pre-Ordovician metamorphism affected the rocks in central Alaska and on southern Prince of Wales Island. Mid-Paleozoic metamorphism probably affected the rocks in east-central Alaska. Most of the metamorphic belts in Alaska developed during Mesozoic or early Tertiary time in conjunction with accretion of many terranes. Examples are Jurassic metamorphism in east-central Alaska, Early Cretaceous metamorphism in the southern Brooks Range and along the rim of the Yukon-Koyukuk basin, and Late Cretaceous to early Tertiary metamorphism in the central Alaska Range. Regional thermal metamorphism was associated with multiple episodes of Cretaceous plutonism in southeastern Alaska and with early Tertiary plutonism in the Chugach Mountains. Where possible, metamorphism is related to tectonism. Meeting participants are encouraged to comment on the present version of the metamorphic facies map.

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Revised Megafossil Biostratigraphic Zonation for Carboniferous of Northern Alaska

Carboniferous megafossils are widely distributed in the Kayak Shale and Lisburne Group throughout the northern Brooks Range. Diverse assemblages of brachiopods, corals, and mollusks, with subordinate echinoderms and bryozoans, were collected from 40 measured sections. The combined stratigraphic ranges and abundances of more than 300 species were assessed to construct a biostratigraphic zonation that can be applied regionally for correlation. Preliminary zonations, used for more than a quarter century, were revised to account for the rapidly accumulating data. The 18 assemblage zones, from youngest to oldest, are: *Umboanctus?* sp., *Corwenia jagoensis, Choristites?* sp., *Delepinoceras* sp., *Siphonodendron ignekensis, Gigantoproductus striatosulcatus-Stelechophyllum?* aff. *S.? mclareni, Goniatites americanus-Siphonodendron lisburnensis, Sciophyllum lambarti, Eumetria costata, Stelechophyllum? mclareni, Naticopsis suturicompta-Lithostrotion reiseri, Skelidorygma subcardiiformis, Spirifer tenuicostatus-Siphonodendron dutroi, Sychnoelasma konincki* s.l.-*Actinocrinites* sp., *Brachythyris choteauensis, Cryptoblastus-Pentremites, Leptagonia analoga,* and *Scalarituba-Lepidodendropsis.*

In the central and western Brooks Range, the deeper water Kuna formation contains a low-diversity fauna of mollusks and brachiopods. Goniatites are found at several levels but never more than two zones in any partial section. Regionally, these goniatite zones, from youngest to oldest, are: *Delepinoceras* (late Chesterian), *Goniatites americanus* (late Meramecian–early Chesterian), *Beyrichoceras* (early to middle Meramecian), *Ammonellipsites* (Osagean) and *Muensteroceras-Protocanites* (late Kinderhookian?).

Correlations of megafossil zones with the foraminiferal zones of Mamet are discussed. The 15 Mississippian zones have an average age-resolution of about 2 m.y. By themselves, the goniatite zones give an age-resolution of about 6 m.y. zone.

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Coal Resources of Northwest Alaska

Rural areas in Alaska depend almost entirely on expensive imported fuel oil for heat and power generation. Following the drastic price increase in petroleum a few years ago, local governments and state agencies have shown considerable interest in determining the potential for northwest Alaska as an alternative energy source. A compilation of earlier work by the U.S. Geological Survey, Bureau of Mines, and industry located over 50 separate coal occurrences within the 50,000 mi^2 Cape Beaufort, Kobuk Valley, Seward Peninsula, and Norton Sound areas. The most promising localities were examined in the field by DGGS and BLM geologists, and six of these were selected for drilling and geophysical surveys by contractors.

Two of the areas drilled were found to have coal of sufficient quantities and quality to justify additional drilling and feasibility studies. The Cape Beaufort–Kukpowruk River area contains Cretaceous-age coal beds up to 20 ft thick and extends from the coast to about 20 mi inland. Drilling under the DGGS-USGS/MMS/BLM-administrated program indicated approximately 20 million tons in the Deadfall syncline alone, where four moderately dipping beds have a 1 to 5 stripping ratio. One 320-acre tract may contain eight million tons of bituminous coal having a 13,000 to over 14,000 Btu value as received.

The other site where work continues is the old Chicago Creek coal mine near Candle on the Seward Peninsula. The coal bed here has been traced by drilling and geophysics for 3,500 ft along strike and found to average 35 ft in thickness. While the deposit is up to 80 ft thick in one drill hole, the coal is lignite and typical of the Tertiary coals in this region, being erratic in character and averaging about 6,900 Btu/lb. Three and one-half million tons of lignite are indicated and another million tons inferred.

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Geological Setting of North Slope Oil Fields, Alaska

The North Slope is a prolific hydrocarbon province in which discoveries to date amount to some 60 billion bbl of oil in place and 50 tcf of gas in place.

Reservoirs and prolific source rocks occur throughout the stratigraphic column, which consists of a lower (or Ellesmerian) megasequence of Carboniferous to Jurassic age and an upper (or Brookian) megasequence of Early Cretaceous to Recent age. Discovered oil is almost equally divided between Ellesmerian and Brookian reservoirs.

Patterns of hydrocarbon generation and migration have been controlled by deposition of clastic sedimentary wedges derived from the Brooks Range orogen. In the Late Jurassic to Early Cretaceous, the main oil kitchen was located in the Western Colville trough. Clastic depocenters and associated kitchen areas migrated progressively eastward with time and are now located in the East Beaufort offshore. Important source rocks include the Jurassic Kingak and Late Triassic Shublik Formations of the Ellesmerian megasequence, and the Aptian-Cenomanian "HRZ" and Turonian-Paleocene Shale Wall formations of the Brookian megasequence.

In the Ellesmerian megasequence, productive reservoirs are known at several stratigraphic levels, with best reservoir properties associated with secondary porosity development in subcrop beneath a mid-Hauterivian unconformity.

The Kekiktuk Formation (Mississippian), oil- and gas-bearing in the Endicott field (ca. 1 billion STBOIP), is a fluvially dominated unit, locally deposited in fault-controlled basins. The Lisburne Group (Mississippian to Early Permian) contains oil in the Lisburne pool of the Prudhoe area (?2-3 billion STBOIP). The reservoir is primarily early diagenetic dolomites within a thick platform carbonate sequence.

The major reservoir on the North Slope is the Early Triassic Ivishak Formation, reservoir to the Prudhoe field (22 STBOIP), the Seal Island discovery (?1 billion STBOIP), and target in the recent Mukluk well. Sands and conglomerates were deposited by a series of alluvial fan deltas shed from a nearby northern landmass.

Arctic Ocean rift events culminated in mid-Hauterivian continental breakup, which generated the subcrop unconformity of the rift margin uplift. Post-unconformity sands associated with local erosion of Elles-