Monday, February 10, 2003

Westchase Hilton • 9999 Westheimer
Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 Nonmembers & Walk-ups

Make your reservations now by calling 713-463-9476 or by e-mail to Joan@hgs.org (include your name, meeting you are attending, phone number, and membership ID#).

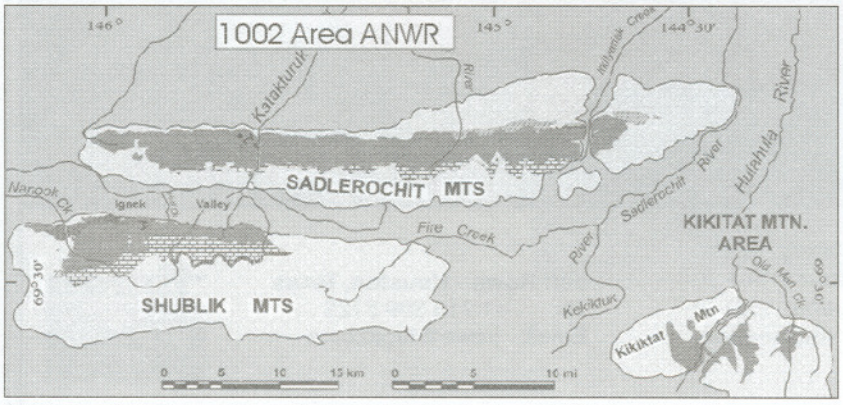
HGS General Dinner Meeting

*by **James G. Clough***
Alaska Division of Geological & Geophysical Surveys, Fairbanks, AK

Pre-Carboniferous Carbonate Oil and Gas Plays in the 1002 Area of the Arctic National Wildlife Refuge, Alaska: Not Just Pretty Basement Complex!

Despite the economic importance of Alaska's North Slope as a major petroleum province containing the continent's largest producing oil field, the early history of Arctic Alaska is among the most poorly understood episodes in the geologic evolution of what is now part of present-day North America. Disparity exists between our understanding of rocks above and below a regional sub-Mississippian angular unconformity developed across northern Alaska. Carboniferous and younger rocks above this unconformity are less intensely deformed, exposed over a broader surface area, have been penetrated by extensive drilling, and have received the bulk of attention from industry and academic geologists. In contrast, the sub-Carboniferous record is a complex assemblage of sedimentary, metasedimentary, and volcanic rocks that have been deformed by early to late Paleozoic orogenic events that predate deposition of the overlying sequences. The anticline cores of the Sadlerochit and Shublik Mountains of the Arctic National Wildlife Refuge (ANWR) contain an over-4-km-thick package of Precambrian through Lower Devonian carbonate, clastic, and igneous "basement complex" rocks, unequaled in northern Alaska, that record the early depositional and tectonic geologic history of Arctic Alaska and warrant much greater attention as potential petroleum reservoir rocks.

Anticline cores of the Sadlerochit and Shublik mountains of the Arctic National Wildlife Refuge (ANWR) contain an over-4-km-thick package of Precambrian through Lower Devonian carbonate, clastic and igneous "basement complex" rocks, unequaled in northern Alaska, … and warrant much greater attention as potential petroleum reservoir rocks.



Map showing the exposed ranges of the Sadlerochit, Shublik and Kikitat Mountains located immediately south of the 1002 Area of ANWR

There are three distinct Pre-Carboniferous megasequences in the Sadlerochit and Shublik Mountains that have bearing on the 1002 subsurface of ANWR. The oldest sequence, consisting of the polydeformed "Nularvik slate and quartzite," represents the stratigraphic record, albeit poorly preserved, of a Proterozoic or older precursor basin. The middle sequence records Neoproterozoic rift to drift passive margin sedimentation and is represented by pillow basalts overlain by the ~2500-m-thick Katakturuk Dolomite. The Katakturuk depicts a southeast-dipping carbonate ramp ➢

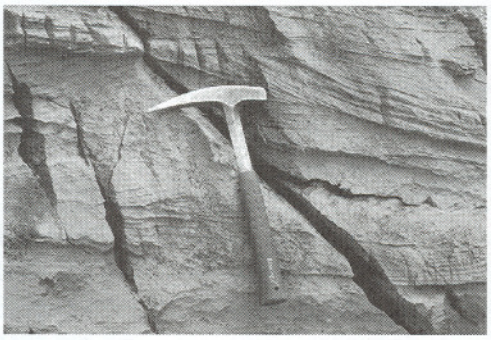
continued on page 11

HGS General Dinner continued from page 9

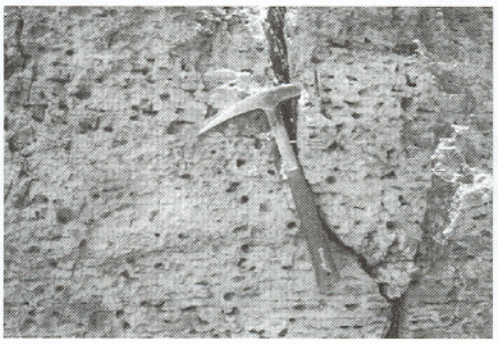
View looking south across the Shublik Mountains toward the Fourth Range

Observations of structural and lateral facies relationships of these three megasequences in the Sadlerochit and Shublik Mountains provide insight into pre-Carboniferous petroleum play strategies in the 1002 area of ANWR north of the mountain front. Northeast-trending normal faults in the middle and upper sequences are perpendicular to the prevailing platform margin facing direction (southeast) suggesting that these faults are extensional in nature and initially formed during Neoproterozoic rifting events associated with passive margin development. Abrupt lateral facies changes in the overlying Nanook Limestone (Cambrian–Ordovician) imply the northeast-trending faults were active in Early Paleozoic time as well, and that the Sadlerochit Mountains were a topographic high during most of Nanook deposition.

complex with a complete spectrum of facies types, from proximal tidal-flat complexes, ramp edge coated-grain oolite to pisolite shoals, and distal allodapic slope deposits. The Katakturuk ramp was an extensive cyclic carbonate depositional system that was terminated by a major karst event marked by widespread cave breccias exposed in the Sadlerochit Mountains. The upper sequence, represented by the Nanook and Mt. Copleston limestones, has a paleodepositional setting similar to the middle sequence, and the distribution of lithofacies indicates a laterally extensive south-facing carbonate platform as well, possibly a carbonate ramp. This sequence's upper boundary is a karst horizon beneath the sub-Mississippian regional unconformity.



Cross-stratified Cambrian-Ordovician Nanook oolitic sandstone



Vugular porosity of weathered Katakturuk Formation

Erosion beneath a sub-Nanook unconformity (Precambrian or Early Cambrian in age) has likely removed the entire Katakturuk section south of the Shublik Mountains. Lower Devonian carbonates (Mt. Copleston Limestone) are restricted to the Shublik Mountains and likely were not deposited to the north—consistent with a northern topographic high or later removal by the sub-Mississippian unconformity. Where not removed by the sub-Mississippian or the Lower Cretaceous unconformities, beneath the 1002 coastal plain north of the mountain front both the upper karst cave-breccia of the Katakturuk Dolomite and the coated-grain facies throughout its entire section are potentially attractive petroleum reservoir targets. Finally, at Hue Creek in the Shublik Mountains, the Katakturuk Dolomite is thrust over the Prudhoe Bay source rock Shublik Formation, providing a tantalizing prospect for "basement complex" petroleum potential in the 1002 subsurface. ■

Biographical Sketch

JIM CLOUGH received a BA in geology from the College of Wooster (Ohio) in 1975. He moved from Ohio to Alaska to pursue a graduate program at the University of Alaska Fairbanks (MS 1981). Jim has been with the Alaska Division of Geological & Geophysical Surveys since 1981 and is Chief of the Energy Resources Section. The focus of Jim's work has been mostly in energy-related endeavors. Between 1985 and 1994, he was the principal investigator of Pre-Mississippian carbonate studies in Arctic National Wildlife Refuge (ANWR), Alaska. Since 1988 he has been principal investigator and project manager for Alaska Coal resources cooperative projects. Currently Jim is manager of the Alaska Coalbed Methane project. He serves as the Pacific Councilor for the AAPG Energy Minerals Division and is a past board member of the Alaska Geological Society. Jim is married and has one daughter in the first grade in Fairbanks, AK.