

# ALASKA GEOLOGY

Newsletter of the  
Alaska Geological Society



## New Insights into the Regional Stratigraphy of the Brookian Sequence in Northern Alaska: Case Studies on the Power of Merging Outcrop and Subsurface Data

**Marwan A. Wartes**

Alaska Division of Geological & Geophysical Surveys, Fairbanks, AK

[marwan.wartes@alaska.gov](mailto:marwan.wartes@alaska.gov)

The Brookian sequence of Alaska's North Slope is a very thick succession of foreland basin siliciclastic sediment shed principally from the Brooks Range and Chukotka orogens. This sequence is host to a number of successful oil and gas fields, including two recently announced major discoveries. In order to improve our understanding of the Brookian depositional system, and encourage additional new exploration, the Alaska Department of Natural Resources has a long-running basin analysis program on the North Slope. This program has historically been principally focused on field geology, but now integrates outcrop-based geologic mapping and stratigraphic studies with analysis of seismic, well log, and other subsurface data. The purpose of this presentation is to highlight several examples where this broad approach has yielded important insight into the tectonic and stratigraphic evolution of the basin, and ultimately improved constraints on exploration models. *(continued)*

### **AGS Luncheon**

**Date & Time:** Tuesday, January 17<sup>h</sup>, 11:30 am – 1:00 pm

**Program:** New Insights into the Regional Stratigraphy of the Brookian Sequence in Northern Alaska:  
Case Studies on the Power of Merging Outcrop and Subsurface Data

**Speaker:** Marwan Wartes, Alaska Division of Geological & Geophysical Surveys, Fairbanks, AK

**Place:** BP Energy Center, 1014 Energy Court, Anchorage, AK

**Reservations:** Make your reservation before noon **Friday, January 13<sup>th</sup>, 2016**

**Cost:** Seminar only, no meal: Free  
Due to low demand catered lunch will no longer be available

For more information call (907) 854-2363 or visit the AGS website: <http://www.alaskageology.org>

### **Brookian orogenic wedge and proximal foreland basin**

The inner foothills of the Brooks Range record complex structural and stratigraphic relationships, complicating attempts to understand the tectonic evolution of the proximal foreland basin and its petroleum system. A high resolution gravity transect has provided evidence that the allochthonous orogenic wedge tapers northward beneath foreland basin deposits. This geophysical data, combined with mapping and stratigraphic studies, suggests a revision of existing tectonic models is warranted. The recognition of a northward thickening wedgetop depozone suggests a burial history that may be more conducive to hydrocarbon preservation. This model also provides an explanation for anomalously low thermal maturities seen along the underexplored southernmost Colville basin.

### **New play concepts in the Hue Shale**

The Hue Shale has long been recognized as the time-transgressive record of condensed basin floor deposition. Outcrop studies on the east-central North Slope discovered Turonian sand-rich facies intercalated within tongues of organic rich Hue Shale. These deepwater facies are often petroliferous and represent a prospective arrangement of source-reservoir-source. Examination of regional well logs suggest this stratigraphic motif is widespread and potentially analogous to the Bermuda-Tarn interval.

### **Sequence stratigraphy of the Upper Cretaceous Schrader Bluff Formation**

The Schrader Bluff Formation is a dominantly shallow marine unit that is locally an important viscous oil reservoir (e.g. West Sak). The interval was originally defined from outcrop exposures along the Anaktuvuk River, east of Umiat. However, the eastward extent of the Schrader Bluff was poorly understood until regional well correlations (Decker, 2007) revealed a pronounced time-transgressive association that can be subdivided into three parts (lower, middle, and upper). This insight provided the framework to re-interpret the map units in the Sagavanirktok River area, and ultimately resulted in a more robust sequence stratigraphic interpretation.

### **Paleocene sedimentation on the eastern North Slope**

Geologic mapping and thermochronology have long demonstrated that the Brooks Range was rejuvenated in the Paleocene. Despite the significance of this exhumational event, little is known about its attendant stratigraphic record in the foreland basin. At Sagwon Bluffs, near the Dalton Highway, a major Paleocene subaerial unconformity has been documented. Analysis of seismic and well data suggest this sequence boundary can be correlated to the east, where the Paleocene shelf margin was incised and deeply eroded during a major base level fall. This surface can be traced into deep-water strata, where significant submarine scouring is evident. Several oil-charged slope-channel and slope-apron turbidite systems have been discovered in association with this lowstand systems tract (e.g. Badami and Flaxman A-1 pools). This Paleocene phase likely coincided with renewed flexural subsidence in the eastern Colville basin, although high rates of sedimentation eventually resulted in the filling of much of the available accommodation.

These selected examples briefly illustrate how the integration of surface and subsurface data has improved our knowledge of regional Brookian stratigraphy. Although many challenges remain, this evolving framework will benefit ongoing and future exploration efforts in this prolific hydrocarbon province.

### **About the Speaker:**

Marwan Wartes has deep roots in northern Alaska, having been born on the Colville Delta where his family was homesteading. He has degrees from the University of Alaska Fairbanks and the University of Wisconsin, Madison. Marwan's background is primarily in outcrop-based stratigraphy and sedimentology; he's conducted fieldwork in a number of regions, most notably Permian nonmarine basins in northwestern China, the Cretaceous foreland basin in northern Alaska, and Jurassic-Cenozoic forearc strata in Alaska's Cook Inlet. His main research interests involve the application of sequence stratigraphy and provenance to regional tectonic problems and petroleum geology. Marwan has led the Alaska Division of Geological & Geophysical Survey's North Slope Program since 2004.