CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Trip Report—Field Study on Alluvial Sedimentation in MacColl Ridge and Cantewell Basin, Southeast and Central Alaska (AI 01402.158.008)

DATE/PLACE: August 7–18, 1999, Alaska

AUTHOR: John A. Stamatakos

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BACKGROUND AND PURPOSE OF TRIP:

In order to take advantage of the Professional Development offered by CNWRA, I spent a week in the field with Dr. Ken Ridgway and colleagues from Purdue University learning about alluvial sedimentation. Dr. Ridgway has an established research program in southeastern Alaska studying the evolution of foreland alluvial basins in a active tectonic settings. His research is supported by research grants from National Science Foundation and Petroleum Research Fund of the American Chemical Society. Many of the rocks in these basins are considered important to petroleum research in Alaska. The tectonics of this part of Alaska is similar in many ways to that of the Yucca Mountain region, especially in the interaction of normal and strike-slip faulting. The basins Dr. Ridgway is studying have been deformed and uplifted in such a way so that a true three-dimensional perspective of sedimentological and structural features can be observed in detail.

SUMMARY OF PERTINENT POINTS:

MacColl Ridge

I arrived in Anchorage on August 7, 1999. On August 8, 1999, Dr. Ridgway, Jeff Trop (his graduate student), and I drove east through the Matanuska Valley (where I did some of my Ph.D. studies many years ago) and across the Copper River Basin to the town of Chitna. From there we flew first by bush planes to the top of the MacColl Ridge, where we made our base camp (Figure 1). MacColl Ridge is a ~2000 m high mesa (20 km wide and 25 km long) situated in the western part of the Wrangell Mountains. It is composed primarily of coarse-grained submarine fan deposits (gravels, sandstones, and shales) with numerous interbedded pyroclastic tuffs (Figure 2). The interbedded tuffs were largely unrecognized until Ridgway and Trop began detailed mapping there several years ago. Recent $^{40}Ar/^{39}Ar$ dates indicate that these vitric-crystalline tuffs are between 78 and 79 million years old, which place their origin in the Late Cretaceous period.

We spent the next seven days on MacColl ridge studying the fan deposits and interbedded tuffs of the MacColl Ridge Formation. Ridgway and Trop showed me details of the sedimentological features in these fan deposits and I learned how these features are used to interpret the sediment source terrain and the tectonic history. In many ways, the tectonic setting of MacColl Ridge represents a larger-scale version of active sedimentation patterns in Yucca Mountain region, that of an integrated volcanic and alluvial system accumulating sediment in an actively subsiding basin. Similar to Crater Flat and Death Valley, sediments aggrade vertically near the locus of the most active faults and prograde horizontally where the fault are relatively inactive. The aggraded sediments are generally coarser grained, poorly sorted and poorly rounded which reflects their near source environment. In contrast, the prograded sediments tend to be better sorted, more rounded, and smaller indicative of the greater amount of time spent in sedimentary transport.

Based on their detailed study of the MacColl Ridge sedimentology, Ridgway and Trop have proposed a new and more detailed tectonic history of the region that greatly improves on previous interpretations, chiefly because they incorporate details of sediment accumulation into their tectonic reconstruction (e.g., Trop et al., 1999). According to Ridgway and Trop, sedimentation in the MacColl basin occurred on the inner portions of a sand and gravel-rich submarine fan system. Sediments in the fan were derived from an uplifted terrane of rocks exposed in the hangingwall of large fault system that separated the basin from a Cretaceous subduction system to the south.

While on MacColl Ridge, I helped Ridgway and Trop sample the MacColl Ridge Formation for paleomagnetic analysis. Previous paleomagnetic studies of theses rocks indicated that they originated at low paleolatitudes, near present-day Baja, Mexico (e.g., Panuska, 1985). According to Panuska (1985), MacColl Ridge was transported nearly 4,000 km northward in the latest Cretaceous and early Tertiary as a composite tectonic microplate. The paleomagnetic results of Panuska (1985), however, are highly controversial because the original data quality was poor, only the sandstones were sampled, and the predicted low paleolatitude is inconsistent with the fossil record. Palynomorphs within the MacColl Ridge Formation indicate intermediate not low-latitude climates.

We collected approximately 130 samples from 21 sites for paleomagnetic analysis. Sampling concentrated on the newly described volcanic tuff units, which typically yield much more reliable paleomagnetic results than the sandstones. These samples were processed at the University of Michigan lab by Trop in November 1999 while I was there making paleomagnetic measurements of Miocene age rocks from Crater Flat. Based on preliminary results from these samples, we are able to show that MacColl Ridge did not originate in low paleolatitudes. Instead we reconstruct the microplate to present-day Oregon, much closer to its present position within the Cordilleran Orogen. Trop presented these results at the 1999 fall American Geophysical Union meeting in San Francisco.

IMPRESSIONS/CONCLUSIONS:

I greatly appreciate the opportunities of Professional Development that allow to remain interested, informed, and active within our respective research communities. I strongly recommend that this program continue.

PROBLEMS ENCOUNTERED:

None.

PENDING ACTIONS:

None.

REFERENCES:

Panuska, B.C. 1985. Paleomagnetic evidence for a post-Cretaceous acretion of Wrangellia. *Geology* 13: 880–883.

Trop, J.M., K.D. Ridgway, A.R. Sweet, and P.W. Layer. 1999. Submarine fan deposystem and tectonics of a Late Cretaceous forearc basin along an accretionary convergent plate boundary, MacColl Ridge Formation, Wrangell Mountains, Alaska. *Canadian Journal of Earth Sciences* 36: 433–458.

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Figure 1. Field camp atop MacColl Ridge in the Wrangell Mountains, Alaska. The view is to the south looking down onto the Chitna River and across to the Chugach Mountains.

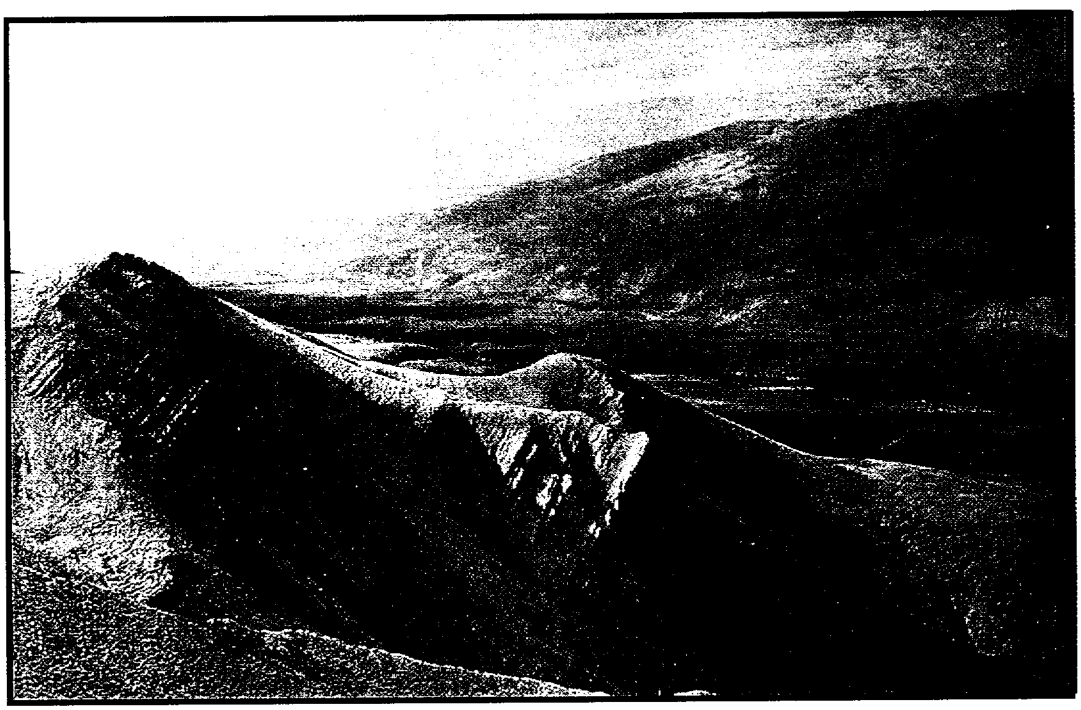

Figure 2. View of the stratigraphic section of Cretaceous sedimentary and volcanic rocks of the MacColl Ridge Formation. The sections is composed primarily of coarse-grained submarine fan deposits (gravels, sandstones, and shales) with numerous interbedded pyroclastic tuffs