Field Guide to the Geology of the Denali National Park Road and the Parks Highway from Cantwell to Healy

Alaska Geological Society
Field Trip - June 21-23, 2013

Chad P. Hults
Geologist, USGS Alaska Science Center

Denny L. Capps
Geologist, Denali National Park and Preserve

Phil F. Brease
Geologist, Denali National Park and Preserve (deceased)

Table of Contents

Acknowledgements

We'd like to thank the USGS, National Park Service, and Murie Science and Learning Center for supporting this field trip. We'd also like to thank the Alaska Geological Society for making this trip possible. We also thank Evan Thoms (USGS) and Guy Adema (NPS) for their review of the guidebook.

Phil Brease was included as an author, because many sections of this guide have been adapted from his unpublished materials produced for his countless field trips and related education activities. His commitment and enthusiasm for interpreting the geologic history of the area resulted in a rich collection of locally relevant geologic summary material. We've posthumously included Phil as an author to respect the information base he developed over his tenure at Denali and to further his tireless interest in sharing the geology of Denali. Phil died while leading a field trip with Healy school students in 2010.

Introduction

The Denali National Park & Preserve area provides one of the few opportunities in Alaska for road-side access to good rock outcrops. The rocks and surficial deposits exposed in the Denali area span from the Paleozoic to the Quaternary. It is a structurally complex area that contains a history of rifting, accretion, and orogeny. There is evidence of multiple metamorphic events in the Mesozoic, mountain building in the Tertiary, and faulting in the present day. The region is the site of active faulting along one of the largest intra-continental fault systems, the Denali Fault system, which was the locus of a 7.9 M earthquake in 2002. Rock units visited during the field trip will include:

- poly-deformed mid-Paleozoic metavolcanic and metasedimentary schist, which records rifting and arc magmatism of the North American margin;
- Triassic greenstone, diabase, and pillow basalt, which probably formed volcanic sea mounts, are associated with Triassic deep-marine shales that were formed in a deep ocean;
- Late Jurassic to Early Cretaceous marine flysch; and mid-Cretaceous mélange containing Devonian limestone olistostroliths, which formed in an ocean between the North American margin and accreting terranes;
- Late Cretaceous fluvial conglomerate and sandstone that contains dinosaur tracks
- Tertiary fluvial and lacustrine conglomerate, sandstone, and shale that record the growth of the Alaska Range;
- and numerous glacial deposits formed during the last ice-age (Gilbert, 1979; Thorson and Hamilton, 1977; Brease, 2008).
    - Teklanika (Late Tertiary, >2 million years ago)
    - Browne (150,000+ years ago)
    - Bear Creek (125,000 to 150,000 ago)
    - Dry-Lignite Creek (125,000 ago)
    - Healy-McLeod Creek (65,000 to 75,000 ago)
    - Riley Creek-Wonder Lake (9,000 to 25,000 ago)
    - Carlo Creek re-advance (8,000 ago)

This guidebook describes the key outcrops viewable along the Denali Park Road from the entrance to the Eielson Visitor Center, and along the Parks Highway from Healy to Cantwell. Previous guidebooks for the area include the following:

- Gilbert (1979): *A geologic guide to Mount McKinley National Park*
- Wahrhaftig (1987): *The Cenozoic section at Suntrana Creek*
- Brease (1989): *The complete history of the Great One! : The historical geology of Denali National Park*
- Brease and Till (1995): *The geology and glacial history of Denali National Park and vicinity*
- Thoms (2005): *Neotectonics of the Central Alaska Range: A Guidebook for the 2005 Alaska Cell - Friends of the Pleistocene Field Trip*

- Brease (2006) - *The geology and glacial history of Denali National Park and vicinity* (Joint GSA, AAPG, SPE, and AGS meeting. Based on Brease and Till (1995), but with revised road log)
- Brease (2008): *The geology and glacial history of Denali National Park and vicinity* (same geology overview sections from various authors as in Brease and Till (1995), but with revised road log)
- McCarthy and Tomsich (2011): *Stratigraphy, Sedimentology and Paleoenvironments of the Cantwell Formation, Denali National Park, Alaska.*

This guidebook provides an introduction to all the outcrops and geologic units encountered during the field trip, and updates to the geological interpretations where new data are available. Of the existing guidebooks, Brease and Till (1995), Brease (2006), and Brease (2008) covered much of the area visited during this field trip and contained numerous chapters with geological overviews of some of the major units exposed in the Denali area. However, those guidebooks were not published and didn't cover the entire area visited during this field trip. In addition there are new publications that revised the interpretations of the geology of the area. The Brease and Till (1995) guidebook, prepared for the 1995 Geological Society of America Cordilleran Section conference in Fairbanks, Alaska, is available for loan from the Alaska Resources Library and Information Services, University of Alaska, Anchorage Library. Since that guidebook was written, Phil Brease continued editing the road log portion of the guidebook to hand out during the numerous informal field trips he led nearly every year. The most recent version of his road log is the Brease (2008) version that was prepared for the Ninth International Conference on Permafrost held in Fairbanks, Alaska. The glaciology portions of Phil's road logs were very thorough, so we have included selected portions of his 2008 and 2006 versions herein and indicate those portions by *italicized* text.

Trip Leaders

Chad Hults is a geologist with the USGS at the Alaska Science Center in Anchorage, Alaska currently working on a new geologic map of Alaska. He was provided the opportunity to live and work in Alaska when he was hired in 2001 as a GSA GeoCorps intern by the former Denali National Park & Preserve geologist, Phil Brease. He worked as a physical scientist at the park until 2006 when he started with the USGS.

Denny Capps has been the geologist for Denali National Park and Preserve since 2011. Before coming to the park he worked mostly in geomorphology, geohazards, glaciology, and remote sensing. Denny first worked in Alaska as a GSA GeoCorps intern for Klondike Gold Rush National Historical Park in 2003. His primary roles at Denali have been informing the park personnel and visitors on issues surrounding multiple aspects of fluvial geomorphology, vertebrate and invertebrate paleontology, geohazards, and geologic education and outreach.