



The Mountains Are Falling Apart: A Spectrum of Mass Failures from Landslides through Deep-Seated Gravitational Spreading (Sackung), to “Unfolding” of Folds

James P. McCalpin

GEO-HAZ Consulting, Inc.

mccalpin@gi.geohaz.com

All engineering geologists can recognize obvious, young landslides from their sharp, distinct geomorphic elements (headscarp, lateral margins, toe thrust, hummocky topography). However, we often see isolated elements without the others and are unsure of their exact origin and engineering significance. Recent geologic mapping in mountainous areas of Alaska, California, Colorado, and Utah, supplemented by LiDAR DEMs, has revealed an abundance of young scarps, graben, bulges, and other geomorphic anomalies. Some landforms are sackungen formed by deep-seated gravitational spreading (called by Doug Morton of USGS “half-a-landslide”). Gravitational spreading results in detachment of large masses of bedrock from mountain flanks, causing lateral bulging and vertical collapse of the crest. Detached blocks do not display hummocky topography because they are not rubble, as are landslide deposits. Instead, stratigraphy and structure within the blocks is relatively undisturbed, so geologic maps show these areas as unfailed bedrock, and do not hint that the block margins are sites of recent deformation with engineering significance. As local relief in mountains increases (often due to valley glaciation in the Pleistocene) and active tectonism increases, the types of different failure styles and number of failures increase. In southern Alaska the combination of high relief and seismic shaking has even led to the Quaternary “toppling-unfolding” of pre-Quaternary folds, due to gravitational spreading and development of extensional flexural-slip faults. Lower-relief areas in Colorado show similar swarms of young scarps related to unfolding of Cretaceous folds by evaporite dissolution in underlying rocks. Taken together, the landforms now known represent a nearly-continuous spectrum of mass failures, ranging in scale from small landslides that we would all be able to recognize, to incipient landslides, to large detached parts of mountains, to deep-seated gravitational spreading that looks almost tectonic in nature. In mountain areas that contain active faults, it is difficult to separate the tectonic-seismogenic structures from the gravitational-nonseismogenic structures, but these two types have different hazard significance for engineering geologists. Two recent conferences in Europe on “Slope Tectonics” explore this topic, which has not yet been recognized in the USA (1st in Lausanne, Feb. 2008, pub. as Geol. Soc. London., Spec. Pub. 351; 2nd in Vienna, Sept. 2011).

AGS Dinner

Date & Time: August 22, 6:30 pm – 8:30 pm

Program: The Mountains Are Falling Apart: A Spectrum of Mass Failures from Land slides through Deep-Seated Gravitational Spreading (Sackung), to “Unfolding” of Folds

Speaker: James P. McCalpin, GEO-HAZ Consulting, Inc., Crestone, CO 81131

Place: Snow Goose (in the private room upstairs)

Reservations: Make your reservation before noon Tuesday, August 20, 2013.

The private room upstairs holds a maximum of 25 people so reservations are essential to ensure a seat!

Cost: Seminar only, no meal: Free

Dinner and drinks: We will order from the regular menu - separate checks

E-mail reservations: vp@alaskageology.org or phone (907) 564-4028

For more information: visit: www.alaskageology.org

About the Speaker:

James P. McCalpin is a Richard H. Jahns Distinguished Lecturer in Engineering Geology sponsored by the Geological Society of America and the Association of Environmental & Engineering Geologists. This talk is based on his research into sackungs since 1994, and on trenching evaporite scarps since 2010. The talk draws on sackungs in Colorado ski areas; a 2-year NSF project trenching classic sackungs in Europe (the type locality); a 2 year mapping and trenching project of sackungs in California's San Gabriel Mountains with Earl Hart (won the AEG Holdredge Award in 2005); 3 years of mapping and trenching landslides and gravitationally-reactivated scarps in Utah, 2 years of trenching sackung scarps in Alaska; and trenching evaporite scarps in Spain and the USA.

The Alaska Geological Society, Inc.

P.O. Box 101288

Anchorage AK 99510

On the web at: <http://www.alaskageology.org>

The Alaska Geological Society is an organization which seeks to promote interest in and understanding of Geology and the related Earth Sciences, and to provide a common organization for those individuals interested in geology and the related Earth Sciences.

This newsletter is the monthly (September-May) publication of the Alaska Geological Society, Inc. Number of newsletters/month: ~300

EDITOR

Ken Helmold

Alaska Geological Society, Inc.

P. O. Box 101288

Anchorage, AK 99510

e-mail: ken.helmold@alaska.gov

(907) 269-8673 (office)

MEMBERSHIP INFORMATION

AGS annual memberships expire November 1. The annual membership fee is \$20/year. You may download a membership application from the AGS website and return it at a luncheon meeting, or mail it to the address above.

Contact membership coordinator Ken Helmold with changes or updates (e-mail: ken.helmold@alaska.gov; phone: 907-269-8673)

All AGS publications are now available for on-line purchase on our website. Check to see the complete catalogue:

<http://www.alaskageology.org/publications>

ADVERTISING RATES

Advertisements may be purchased at the following rates:

1/10 Page--\$190/9mo, \$75/1mo; size=1.8 x 3.5 inch

1/4 Page--\$375/9mo, \$95/1mo; size=4.5 x 3.5 or 2.2 x 7.5 inch

1/3 Page--\$470/9mo, \$105/1mo; size=7.0 x 3.5 or 3.0 x 7.5 inch

1/2 Page--\$655/9mo, \$125/1mo; size=9.0 x 3.5 or 4.5 x 7.5 inch

Full Page--\$1000/9mo, \$165/1mo; size=7.5 x 9.0 inch

1mo rate=(9mo rate/9)+\$50 (rounded up).

Contact Keith Torrance (614) 264-4506 for advertising information.