KECK GEOLOGY CONSORTIUM

PROCEEDINGS OF THE TWENTY-SECOND ANNUAL KECK RESEARCH SYMPOSIUM IN GEOLOGY

April 2009
Franklin & Marshall College, Lancaster PA.

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2008-2009 PROJECTS

THE BLACK LAKE SHEAR ZONE: A POSSIBLE TERRANE BOUNDARY IN THE ADIRONDACK LOWLANDS (GRENVILLE PROVINCE, NEW YORK)
Faculty: *WILLIAM H. PECK*, *BRUCE W. SELLECK* and *MARTIN S. WONG*: Colgate University
Students*: JOE CATALANO*: Union College; *ISIS FUKAI*: Oberlin College*; STEVEN HOCHMAN*: Pomona College; *JOSHUA T. MAURER*: Mt Union College*; ROBERT NOWAK*: The College of Wooster*; SEAN REGAN*: St. Lawrence University*; ASHLEY RUSSELL*: University of North Dakota; *ANDREW G. STOCKER*: Claremont McKenna College; *CELINA N. WILL*: Mount Holyoke College

PALEOECOLOGY & PALEOENVIRONMENT OF EARLY TERTIARY ALASKAN FORESTS, MATANUSKA VALLEY, AL.
Faculty: *DAVID SUNDERLIN*: Lafayette College, *CHRISTOPHER J. WILLIAMS*: Franklin & Marshall College
Students: *GARRISON LOOPE*: Oberlin College; *DOUGLAS MERKERT*: Union College; *JOHN LINDEN NEFF*: Amherst College; *NANCY PARKER*: Lafayette College; *KYLE TROSTLE*: Franklin & Marshall College; *BEVERLY WALKER*: Colgate University

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Students: *AVERY R. COTA*: Minnesota State University Moorhead; *JANE DIDALEUSKY*: Smith College; *ROWAN HILL*: Colorado College; *ANNA PENDLEY*: Washington and Lee University; *MAIJA SIPOLA*: Carleton College; *STACEY SOSENKO*: Franklin and Marshall College

GEOLOGY OF THE HÖH SERH RANGE, MONGOLIAN ALTAI
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Students: *ELIZABETH BROWN*: Occidental College; *GIA MATZINGER, ANDREA SEYMOUR, RYAN J. LEARY*, *KELLY DUNDON* and *CHELSEA C. DURFEY*: Whitman College; *BRITTANY GAUDETTE*: Mount Holyoke College; *KATHRYN LADIG*: Gustavus Adolphus College; *GREG MORTKA*: Lehigh U.; *JODI SPRAJCAR*: The College of Wooster; *KRISTIN E. SWEENEY*: Carleton College.

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Students: *ALANA BARTOLAI*: Macalester College; *EMMA KRAVET and CONOR VEENEMAN*: Wesleyan University; *RACHEL NEURATH*: Smith College; *JESSICA SCHEICK*: Bryn Mawr College; *DAVID JAKIM*: SUNY.

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Keck Geology Consortium: Projects 2008-2009
Short Contributions – MONGOLIA

GEOLOGY OF THE HÖH SERH RANGE, MONGOLIAN ALTAI

NICHOLAS E. BADER and ROBERT J. CARSON: Whitman College
A. BAYASGALAN: Mongolian University of Science and Technology
KURT L. FRANKEL: Georgia Institute of Technology
KARL W. WEGMANN: North Carolina State University

APATITE FISSION TRACK THERMOCHRONOLOGY OF THE HÖH SERH RANGE, MONGOLIAN ALTAI

ELIZABETH BROWN: Occidental College
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CHARACTERIZATION OF THE HÖH SERH AND TSAGAAN SALAA FAULTS, HÖH SERH RANGE, MONGOLIAN ALTAI

***KRISTIN E. SWEENEY*:** Carleton College
Research Advisor: Sarah Titus
TSOLMON ADIYA: Mongolia University of Science and Technology

CALCULATING THE RATE OF DEXTRAL STRIKE-SLIP MOTION ALONG THE HÖH SERH FAULT, MONGOLIAN ALTAI

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Research Advisor: Shelley Judge
ERDENEBAT BOLOR : Mongolia University of Science and Technology

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***CHELSEA C. DURFEY*:** Whitman College
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***JARGAL OTGONKHUU*:** Mongolian University of Science and Technology

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A LARGE GLACIAL-OUTBURST DEBRIS FLOW DEPOSIT, HÖH SERH RANGE, MONGOLIAN ALTAI.

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RECONSTRUCTING LATE HOLOCENE CLIMATE THROUGH TREE-RING ANALYSIS OF SIBERIAN LARCH: ALTAI MOUNTAINS, WESTERN MONGOLIA

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JODI SPRAJCAR: The College of Wooster
ERDENEBAT BOLOR: The Mongolian Institute of Science and Technology
Research Advisor: Shelley Judge

INTRODUCTION

The Mongolian Altai accommodates strain caused by a combination of the Indo-Asia collision over 2500 km to the southwest (Cunningham et. al, 1998) and uplift of the Hangay Dome directly to the east (Tapponier and Molnar, 1979, Baliginnyan et al., 1993, Cunningham, 1998). The Mongolian and Gobi Altai comprise a conjugate fault set that is rotating in order to make room for India (Molnar and Tapponier, 1975). Much of the current motion in the Mongolian Altai is thought to occur along northwest-trending reactivated Paleozoic structures (Cunningham, 1998). Strike-slip faults within the Mongolian Altai and along its borders, like the dextral Höh Serh fault, rupture in response to the far-field stresses resulting from India-Asia collision. Drainage channels, ridges, and moraines are offset along the entire trace of the Höh Serh fault (HSF). These offsets range from 10 m to 1500 m along the central sections of the fault (Wegmann et al., 2008). We measured distances of offset drainages and shutter ridges in order to determine slip rates for a portion of the Höh Serh fault.

OBSERVATIONS

We collected detailed field observations along the HSF near Lake Valley, between Goat in Arms Pass to the north and the Lake Valley Offset to the south. The northern portion of the field area contains talus-covered slopes with recently-formed drainage channels that were not offset by the fault, and therefore are not relevant to this study. Lake Valley was glaciated during the Last Glacial Maximum, approximately 35 ka Just south of Lake Valley lie three large landslides, which were deposited vertically on top of each other. These landslides were most likely the result of the seismic activity that occurred at Lake Valley Offset. Lake Valley Offset, just south of the three landslides, has obvious offset channels and shutter ridges.

METHODS

Following initial reconnaissance of the field area, we surveyed and measured the two offset channels and the shutter ridge using differential GPS (DGPS). There are two channels present at Lake Valley Offset, Channel One (C-1) and Channel Two (C-2, Fig. 1). C-1 is the southernmost channel and C-2 is the northernmost channel.

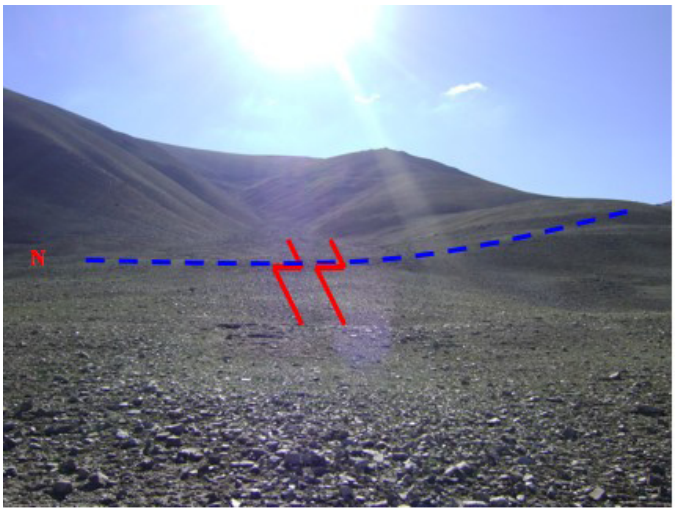

Figure 1. Photo showing Lake Valley Offset. The lines are depicting the trace of the fault (red) and offset channels (blue).

In order to measure the length of offset along the channels, we determined the point at which the drainage path changes directions once it interacts with the fault. The HSF offsets these channels right-laterally. After a distance following the trace of the fault (the offset distance), the channel returns to its original path downslope, which is almost perpendic-

ular to the fault scarp. Horizontal distance between offset channel features was measured with a measuring tape and differential GPS, using the thalwegs as piercing points. The displacement between three marker points, two offset channels and one offset bedrock ridge were measured.

The age of the fan was determined with cosmogenic nuclide ^{10}Be geochronology. Maximum, median, and minimum slip rates for the HSF were determined from the measured offset of the geomorphic features and from the fan age.

A GIS map of the Lake Valley Offset was produced with elevation and range data collected with differential Trimble GeoXH GPS instruments. DGPS transects across the fault were spaced at 1 m intervals covering the width of the field site (Fig. 2). Survey data were imported into the Surfer software package with which contour maps of the field area were generated.

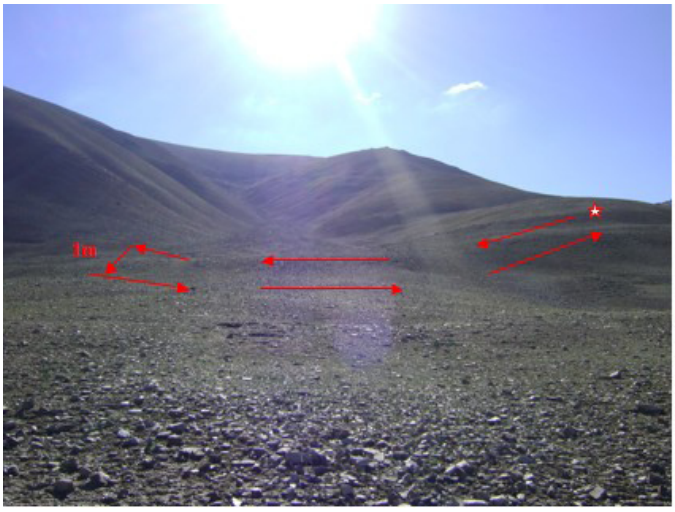

Figure 2. Photo of Lake Valley Offset from the west. Path of dGPS survey is denoted by red arrows.

RESULTS

A scarp is preserved along the trace of the HSF across the mouth of Lake Valley and three large landslides were mapped along the fault trace at the valley's southern edge.

There are two ephemeral alluvial fan channels (C-1 and C-2) present at the Lake Valley Offset, just south of the landslides (Fig. 3). The fault scarp has a gentler slope than the rest of the mountain front, causing the channels to follow the scarp's trace for a distance as it crosses the alluvial fan, before returning to their pre-displacement courses (Fig. 3).

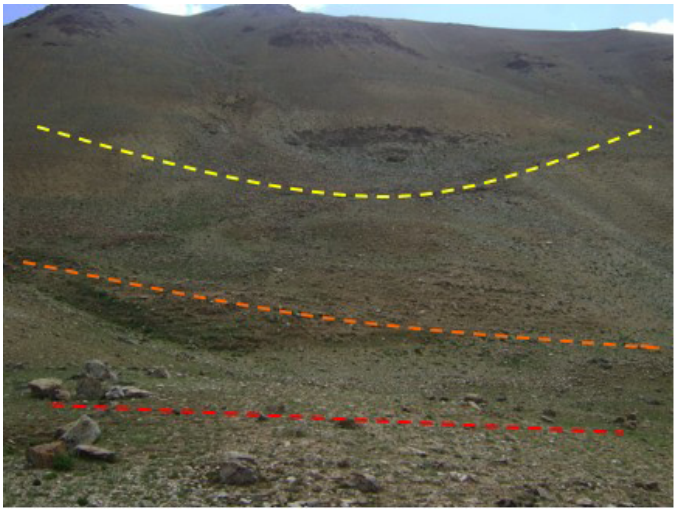

Figure 3. Photo showing the three landslides and their vertical relationship to one another.

Channel 1 and 2 are dextrally offset 15 to 20m (Table 1). At Channel 1 an offset of 15.7 m was measured. The width of Channel 1 is approximately 6.5 m. The width of C-2 is approximately 4.5 m. The bedrock ridge south of C-1 is offset 19.3 m. All three features are offset in a dextral-sense, and the average offset is 17 m (Table 1).

We used cosmogenic nuclide ^{10}Be geochronology to determine the age of the offset fan. Five cosmogenic surface exposure ages from quartzite cobbles on the fan surface yield an age of 15 +/- 2 ka. Using this age range, the estimated rate of fault slip is about 1.2 mm/yr.

DISCUSSION AND CONCLUSIONS

Measured offsets were probably produced by repeated earthquake activity along the Hoh Serh fault. The three landslides just north of the Lake Valley Offsets are circumstantial evidence supporting an

Offset Feature	Distance Offset (meters)	Channel Width
Channel 1 (Southern Channel)	15.7 meters	~6.5 meters
Channel 2 (Northern Channel)	17.5 meters	~4.5 meters
Ridge Offset	19.3 meters	N/A

Table 1. Recorded offsets of channel and ridge features.

earthquake origin for the measured ground-surface displacements. Based on the measured fault offset of ~17 m and the 10Be age of ~15ka, the average dextral slip rate of the Hoh Serh fault is ~1.2 mm/y over the late Pleistocene.

FUTURE WORK

Due to the nature of this fieldwork, there were a lot of aspects of the study that have the ability to be further examined and studied in order to make more definitive conclusions from the observations. Future work in this area would include an in-depth study of the landslides located just north of Lake Valley Offset and a more in-depth look at the relationship between the HSF and Lake Valley Moraine. Finally, obtaining the cosmogenic dates from the samples collected during fieldwork will help to narrow down and determine a more accurate date of the faulting along the HSF.

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