Paul W. Jewell

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Research philosophy

The major thrust of my research is applying hydrologic principles and models to fundamental problems of sedimentation, geomorphic evolution, and geochemistry in surface water environments. This is accomplished by acquiring critical field data on and incorporating them into models of varying sophistication. I am presently working on three surface environments: Pleistocene Lake Bonneville in the western United States (in collaboration with Marjorie Chan and Kathleen Nicoll of the University of Utah), alluvial channels in the intermountain west, and pit mine lakes.

Potential graduate student research projects

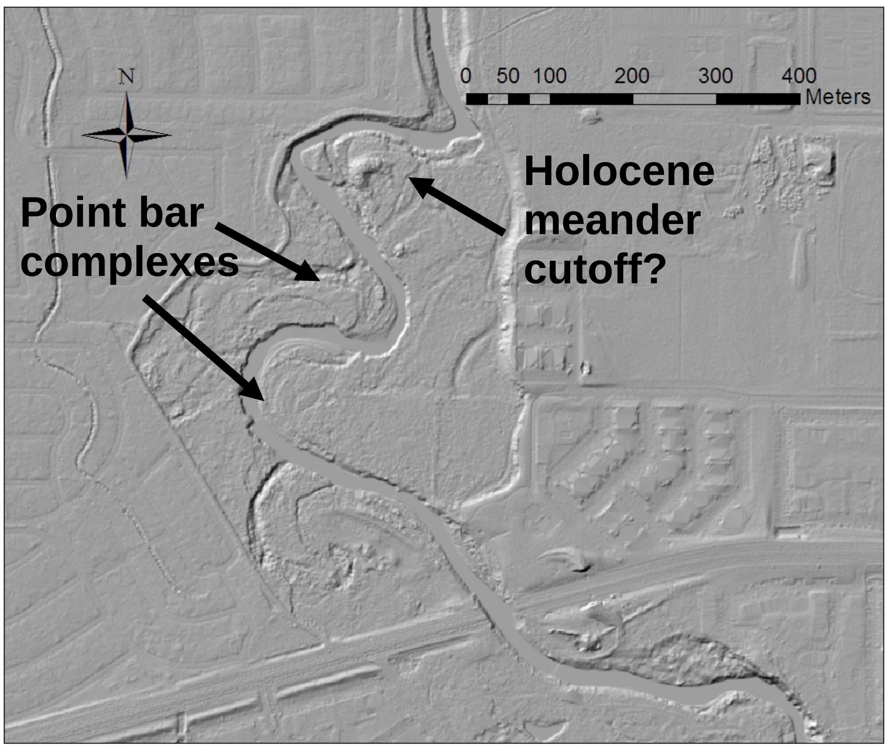
I hope to recruit new graduate students to work on the following projects over the next several years. Potential graduate students should contact me at paul.jewell@utah.edu if they have specific questions.

Erosional processes

The understanding of erosional processes on the surface of the Earth is critical from both a scientific and societal perspective. The primary mapping tool for this work is LiDAR (Light Detection and Ranging) techniques using both ground and airborne platforms. LiDAR produces thousands of laser pulses per second to extraordinarily detailed images of a variety of features. The accuracy of ground based is on the order of centimeters, promising unparalleled understanding of a variety of geomorphic and sedimentary environments. Two of these environments are under active investigation.

1. Alluvial channels. The scientific understanding and management of alluvial channels is one of the most important problems in process geomorphology. Scientific problems are wide ranging and particularly acute in the western United States where demands from water consumers, recreationists, fisherman, and farmers have created a myriad of conflicting goals regarding the management of stream and river resources. Accurate and rapid characterization of this environment and application of predictive models are critical tools for proper management of alluvial resources. Recent advances in digital mapping, analysis, and numerical modeling hold tremendous potential for developing a new generation of models that can be rapidly applied to alluvial systems. This arena of research can advance the understanding of alluvial processes and is applicable to a variety of topics including stream restoration, nonpoint source pollution (including transport of mining wastes), floodplain management, and understanding global sediment flux. At the present time, I have an M.S. student working understanding the sedimentary architecture of small streams (such as the one shown below) that are undergoing significant incision as a result of the historic low stand of the Great Salt Lake.

Recent channel development of Lee Creek as it enters the Great Salt Lake. The drought of the past seven years has produced a 2 m drop in lake base level and producing rapid downcutting and significant sediment transport into the lake.



Airborne LiDAR image of the Jordan River in urban Salt Lake County showing Holocene alluvial features unobservable with standard aerial imagery.

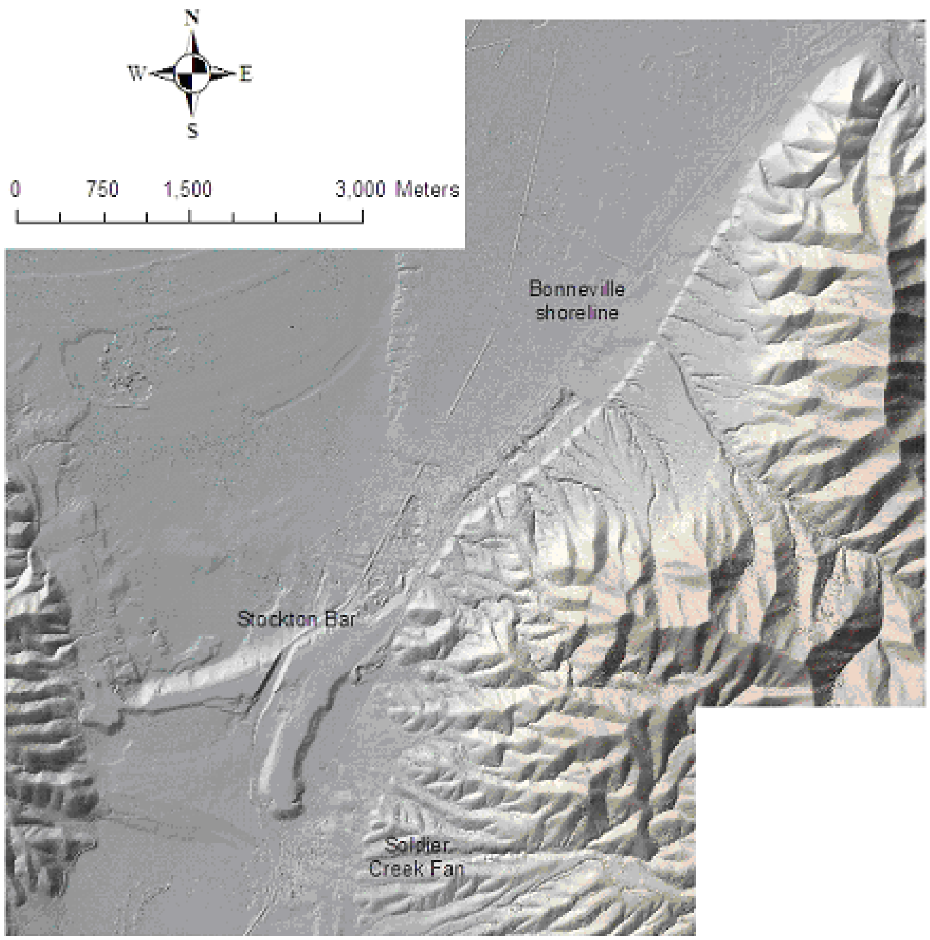
2. Bryce Canyon National Park. **A relatively new project will attempt to quantify the rates of erosional processes and formation of geomorphic features in Bryce Canyon National Park. Initial ground-based LiDAR surveys will be undertaken in the spring of 2009 with more detailed studies to follow.**

View of the Bryce Canyon amphitheather showing the erosional scarp in the upper member of the upper pink limestone member of the Eocene Claron Formation (left) which gives way to prominent hoodoos in the lower pink limestone member.

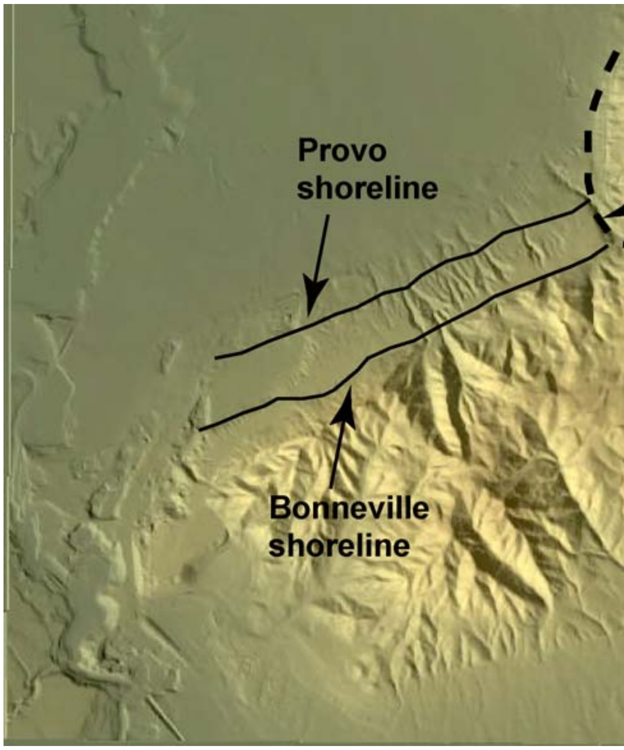
Lake Bonneville

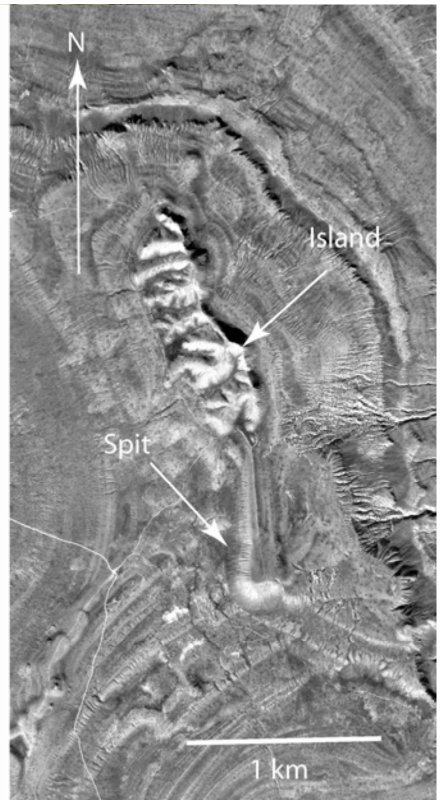
Pleistocene Lake Bonneville was the largest of several pluvial lakes that formed in the Great Basin of the western United States during the last glacial maximum. Over the past century, Lake Bonneville has provided a wealth of paleoclimate information about the continental interior of North America. During lake high stands, a variety of sedimentological and geomorphic features formed in response to circulation, river runoff, and wave action. Understanding the genetic mechanisms operative during formation of these deposits has important scientific consequences for the paleoclimate of the Great Basin.

Numerical modeling studies of Lake Bonneville are being used to establish relationships between the field features of the lake and specific hydrodynamic characteristics which in turn are a function of Late Pleistocene climate forcings in the Great Basin. These studies have the potential for predicting a number of features of interest to engineering geologists working in the Bonneville basin. Student projects so far have emphasized deltas, large spits, and tufa development in the basin. A current Ph.D. project by Daren Nelson is emphasizing shoreline development and evolution using airborne LiDAR and field mapping.



The Stockton Bar complex, approximately 50 miles southwest of Salt Lake City is one of the most important geomorphic features of Lake Bonneville. The bar formed by the removal of alluvial fan material and its transport to the southwest by long shore currents.

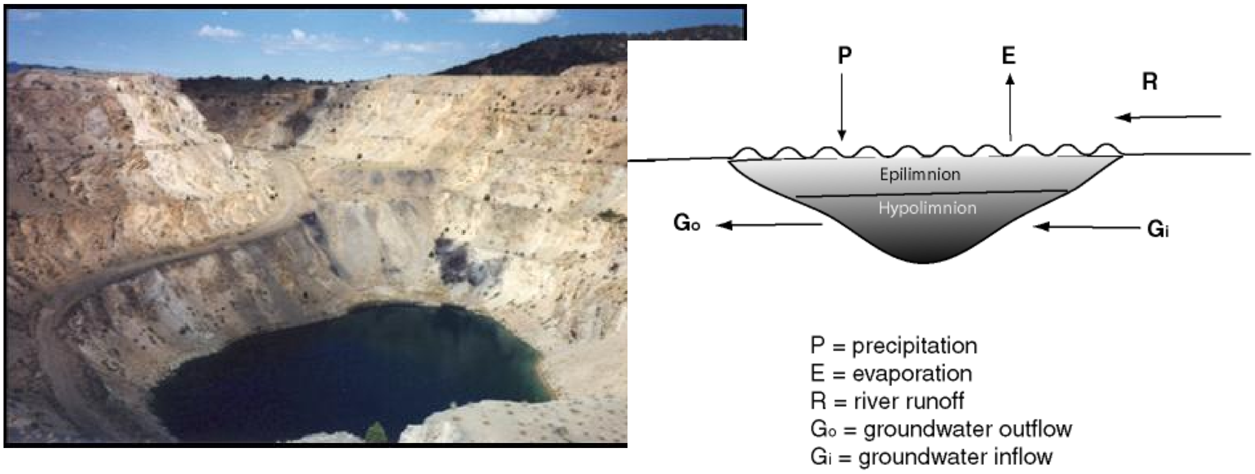




DEM of shoreline features and the Wasatch fault at Point of the Mountain, south of Salt Lake City (left). Prominent spit of Lake Bonneville (right) (Jewell, 2007).

Pit lake hydrology

Pit lakes form where a water table that has been depressed during mine dewatering recovers following removal of bulk mineable ore or aggregate material. A number of environmental concerns surround pit mine lakes, the most critical of which is longterm evolution of lake water quality and its impact on the surrounding groundwater. Interaction of surface and ground water with freshly exposed, mineralized rock can cause concentration of metals and other elements in the pit lake waters to rise above that of ambient groundwater. Evaporation of waters in the lake can lead to further solute concentration. Concerns of water quality associated with the large increase in open pit gold mining operations during the 1980s and 1990s has accelerated research on pit lake hydrology. While this project is not currently active, two critical aspects of pit mine lakes need to be investigated: physical limnology of the lake (which can lead to permanent stratification and anoxia) and the degree to which surface water and infiltration surrounding mined lands make its way into the lake.



This pit lake in the Iron Springs mining district of southwestern Utah has been filling for the past 20 years. The physical limnology of the lake was investigated by a recent M.S. student (Devin Castendyk) using field measurements and simple mass balances of the hydrology.

Recent graduate student careers:

***Student*: Krysia Skorko (B.S., Vassar College)**
***Period*: 2008 – 2009**
Thesis title: Fluvial response to Great Salt Lake level changes: observations, mechanisms, and implications
***Degree*: M.S.**
Present position: Geologist, Questar Corporation, Salt Lake City, Utah

***Student:* Alisa Felton (B. S., University of California, Santa Cruz)**
***Period:* 2000 - 2003**
***Thesis title:* Paleowave indicators and model for tufa Development in the Lake Bonneville Basin, Utah**
***Degree:* M.S.**
***Present position:* Earth science teacher, Salt Lake School District.**

***Student:* Ian Schofield (B. S., State University of New York, Plattsburgh)**
***Period:* 1999 - 2002**
***Thesis title:* Longshore transport and surface wave modeling associated with spit formation in Pleistocene Lake Bonneville**
***Degree:* M.S.**
***Present position:* Hydrologist, CH2M Hill, Inc., Salt Lake City.**

Student: **Scott Tangenberg (B. S., University of Colorado)**
Period: **1997 - 2000**
Thesis title: **Alkalinity sources in an alpine watershed, northern Utah**
Degree: **M.S.**
Present position: **Hydrologist, U. S. Forest Service, Susanville, California**

Student**: Devin Castendyk (B. S., Hartwick College)**
Period**: 1996 - 1999**
Degree**: M.S.**
Thesis title**: Chemical, hydrologic, and limnologic interactions at three pit mine lakes in the Iron Springs Mining district, Utah**
Present position: **Assistant Professor, State University of New York, Oneida**

Student**: Charles Williamson (B. S., University of Utah)**
Period: **1996 - 1999**
Thesis title: **Evolution of anoxic conditions during deposition of the Pilot Shale and Leatham Formation (Upper Devonian), Utah and Nevada**
Degree: **M.S.**
Present position: **Hydrologist, Division of Water Quality, State of Utah.**

Student**: Jennifer Joyce (B. S., Tulane University)**
Period**: 1993-1996**
Degree**: M.S.**
Thesis title: **Physical and chemical controls of methane flux from two tropical reservoirs**
Present position: **Geologist, Exxon-Mobil, Inc., Houston, Texas**

Publications

Jewell, P. W., and K. Nicoll, in review, Wind regimes and aeolian transport in the Great Basin, U.S.A.: *Geomorphology*.

Jewell, P. W., 2010, River incision, circulation, and wind regime of Pleistocene Lake Bonneville, U.S.A.: *Paleoecology, Paleoclimatology, and Paleogeography*, v. 293, p. 41-50

Jewell, P. W., K. W. Skorko, and J. C. Fernandez, 2010, LiDAR analysis of an urban alluvial system: Jordan River, Utah: *Association of Environmental and Engineering Geologists News*, v. 54, No. 1, p. 20-22 (invited submission).

Jewell, P. W., 2009, Stratification controls of pit mine lakes, *Mining Engineering*, v. 60, p. 74-79.

Jewell, P. W., 2007, Morphology and paleoclimate significance of Pleistocene Lake Bonneville spits: *Quaternary Research*, v. 68, p. 421-430.

Felton, A., P. W. Jewell, M. A. Chan, and D. Currey, 2006, Controls of tufa development in Pleistocene Lake Bonneville, Utah: *Journal of Geology*, v. 114, p 377-389.

Schofield I., P. W. Jewell, M. A. Chan, D. Currey, and M. Gregory, 2004, Longshore transport, spit formation, and surface wave modeling, Pleistocene Lake Bonneville, Utah: *Earth Surface Processes and Landforms,* v. 29, p.1675-1690.

Joyce, J. A., and P. W. Jewell, 2003, Physical controls of methane ebullition from reservoirs and lakes: *Environmental and Engineering Geoscience*, v 9, p. 77-88.

Jewell, P. W., N. J. Silberling, and K. M. Nichols, 2000, Geochemistry of the Mississippian Delle phosphatic event, eastern Great Basin, U.S.A: *Journal of Sedimentary Research*, v. 70, p. 1230-1241.

Jewell, P. W., 2000, Bedded barite in the geologic record, in C. R. Glenn, J. Lucas, and L. Prevot, editors., Marine authigenesis: from global to microbial: *SEPM Special Publication 66.* p. 147-161.

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