

The following application was submitted to the MARGINS Office:

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Elana Leithold

Category: Professor

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Statement of interest:

I would like to attend this workshop in order to participate in planning future collaborative research in the Waipaoa Source-to-Sink field area. My recent research has focused on the role of sedimentary processes in carbon burial, and I am particularly interested in investigating the impacts of climate and land use changes on sediment-carbon interactions in both terrestrial and marine environments. Along with my colleague, Neal Blair, I have recently obtained funding from NSF to investigate the control of sediment yield on the age of particulate organic carbon discharged from small mountainous rivers, including the Waipaoa and Waiapu. Our long-term goal is to understand how the residence time of sedimentary particles in various terrestrial and marine reservoirs en route from exhumed bedrock to burial on the continental shelves and slopes impacts the age, concentration, and composition of the associated organic carbon. Ultimately, my objective is to turn the problem around and use the character of organic carbon in continental margin stratigraphic sequences as a tool for reconstructing surface processes over time.

Short resume:

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PROFESSIONAL PREPARATION

University of Wisconsin-Madison, Geology and Geophysics, B.S., 1980
University of Washington, Geological Sciences, M.S., 1984
University of Washington, Geological Sciences, Ph.D. 1987

APPOINTMENTS

1993-present Associate Professor, Department of Marine, Earth, and
Atmospheric Sciences, North Carolina State University

1987-1993 Assistant Professor, Department of Marine, Earth, and
Atmospheric Sciences, North Carolina State University

AREAS OF EXPERTISE

Modern and ancient marine sedimentation and stratigraphy, sediment transport,
marine carbon burial, Earth history

PROFESSIONAL AFFILIATIONS AND SERVICE

American Geophysical Union
Geological Society of America
Society of Economic Paleontologists and Mineralogists
Member of the Research Committee (1992-1994)
Associate Editor, Journal of Sedimentary Research (1994-1996)
American Chemical Society Petroleum Research Fund
Member of the Administrative Board (1998-2003)

SELECTED SPONSORED RESEARCH:

"High-frequency sea-level changes and paleoceanography of the Cenomanian-
Turonian Western Interior Seaway," National Science Foundation, March 1, 1993-
February 29, 1996, collaborative project with Dr. Mark Leckie, University of
Massachusetts

"Sedimentary fabric and organic carbon preservation along a Cretaceous gradient
of sediment accumulation rate," American Chemical Society, March 1, 1993-August
31, 1995, Leithold sole P.I.

"STRATAFORM studies of seabed processes," Office of Naval Research (through
subcontract to Humboldt State University), October 1, 1994-September 30, 1996;
collaborative project with Dr. Jeffry Borgeld, Humboldt State University

"Following the fate of flood layers on the northern California continental
margin," Office of Naval Research, October 1, 1996- December 31, 1997; Leithold,
sole P.I.

"Organic carbon burial in marine sediments: Processes controlling the organic
carbon load on mineral surfaces in a coupled river/continental margin system,"

American Chemical Society Petroleum Research Fund, May 1, 1998-February 28, 2001; Neal Blair co-PI.

"Organic carbon loading on marine sedimentary particles as an indicator of river basin weathering and transport regimes," National Science Foundation, Marine Geology and Geophysics Program, January 1, 1999-August, 2002; Neal Blair co-PI.

"Age distribution of the POC discharged from small mountainous rivers-- the influence of sediment yield and soil residence time," National Science Foundation, Integrated Carbon Cycle Research, October 1, 2002-September 30, 2006; Neal Blair co-PI.

Selected Publications:

Leithold, E.L., 1989, Depositional processes on an ancient and modern muddy shelf, northern California: *Sedimentology*, v.36, p.179-203.

Leithold, E.L., and Bourgeois, J., 1989, Sedimentation, sea level change, and tectonics on an early Pleistocene continental shelf, northern California: *Geological Society of America Bulletin*, v. 101, p.1209-1224.

Leithold, E.L., 1993, Preservation of laminated shale in ancient clinoforms: comparison to modern subaqueous deltas: *Geology*, v. 21, p.359-362.

Leithold, E.L., 1994, Stratigraphical architecture at the muddy margin of the Cretaceous Western Interior Seaway, southern Utah: *Sedimentology*, v. 41, p.521-542.

Sethi, P.S., and Leithold, E.L., 1994, Climatic cyclicity and terrigenous sediment influx to the early Turonian Greenhorn Sea, southern Utah: *Journal of Sedimentary Research*, v. B64, p.26-39.

Levin, L.A., Leithold, E.L., Gross, T.F., Huggett, C.L., and DiBacco, C., 1994, Contrasting effects of substrate mobility on infaunal assemblages inhabiting two high-energy settings on Fieberling Guyot: *Journal of Marine Science*, v.52, p.489-522.

Wheatcroft, R.A., Borgeld, J.C., Born, R.S., Drake, D.E., Leithold, E.L. Nittrouer, C.A., and Sommerfield, C.K., 1996, The anatomy of an oceanic flood deposit: *Oceanography*, v.9, p.158-162.

Sethi, P.S., and Leithold, E.L., 1997, Recurrent depletion of benthic oxygen and enhancement of organic carbon preservation with third-order transgressive maxima in the Cretaceous Western Interior Seaway: *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 128, p.39-61.

Leithold, E.L., and Hope, R.S., 1999, Deposition and modification of a flood layer on the northern California shelf: lessons from and about the fate of terrestrial particulate organic carbon: *Marine Geology*, v.154, p.183-195.

Leithold , E.L., and Blair, N.E., 2001, Watershed control on the organic loading of marine sedimentary particles: *Geochimica et Cosmochimica Acta* v. 65, p.2059-2068.

Blair, N.E., Leithold, E.L., Ford, S.T., Peeler, K.A., Holmes, J.C., and Perkey, D.W., 2003, The persistence of memory: the fate of ancient sedimentary carbon in a modern sedimentary system: *Geochimica et Cosmochimica Acta*, v. 67, p.63-73.

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ABSTRACT

Title:

The Evolution Of Sediment-Organic Associations From Source To Sink

Authors:

Elana L. Leithold and Neal E. Blair
North Carolina State University

Abstract:

Much of the organic carbon (OC) buried on continental margins is strongly bound to sedimentary particles derived from bedrock exposures on land. The OC undergoes a series of transformations en route from terrestrial sources to marine sinks. As sedimentary rocks are uplifted and weathered, for example, ancient sedimentary carbon (kerogen) may be oxidized in the regolith and partially replaced by modern, plant-derived OC. Once discharged to the ocean, marine OC may replace or be added to the OC load of mineral particles in the surface mixed layer of the seabed. The extent to which these transformations proceed is governed by the residence time of the particles in various intermediate, near-surface environments. Progression toward understanding carbon cycling on continental margins and toward more effectively using OC as a tool for reconstructing past environments requires an understanding of sedimentary particle histories from exhumation to burial.

The Waipaoa system exemplifies the small mountainous rivers that characterize active margins and provide more than half of the sediment discharged annually to the oceans. Our previous work in a similar setting, the Eel River in northern California, led us to the hypothesis that the survival and reburial of kerogen are common features of such systems. Currently we are testing the idea that rates of erosion control the extent to which kerogen survives to be delivered to the marine environment by studying five watersheds with a range of sediment yields. The Waipaoa and Waiapu are two of our targeted rivers.

The well-documented and dramatic acceleration of erosion since European

deforestation of the Waipaoa watershed offers an ideal opportunity to investigate the effect of land use on carbon burial. On the Eel shelf, we have examined a 2000-yr record of sedimentation and have documented a 7- to 10-fold increase in sediment accumulation since extensive timber harvesting began in the 1950's. Attendant with this change, the loading of mineral particles with both modern terrestrial and marine OC has decreased, apparently reflecting accelerated rates of both mass wasting in the watershed and burial at sea. More detailed studies of contemporary processes and depositional records in the Waipaoa system would shed further light on the impact of anthropogenic changes on continental margin carbon cycling and its stratigraphic signatures.

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