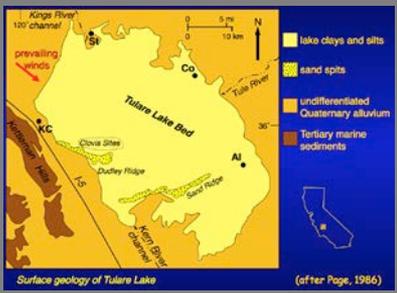
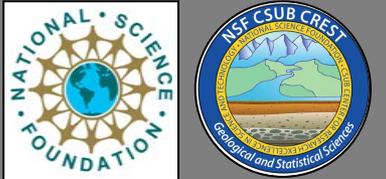
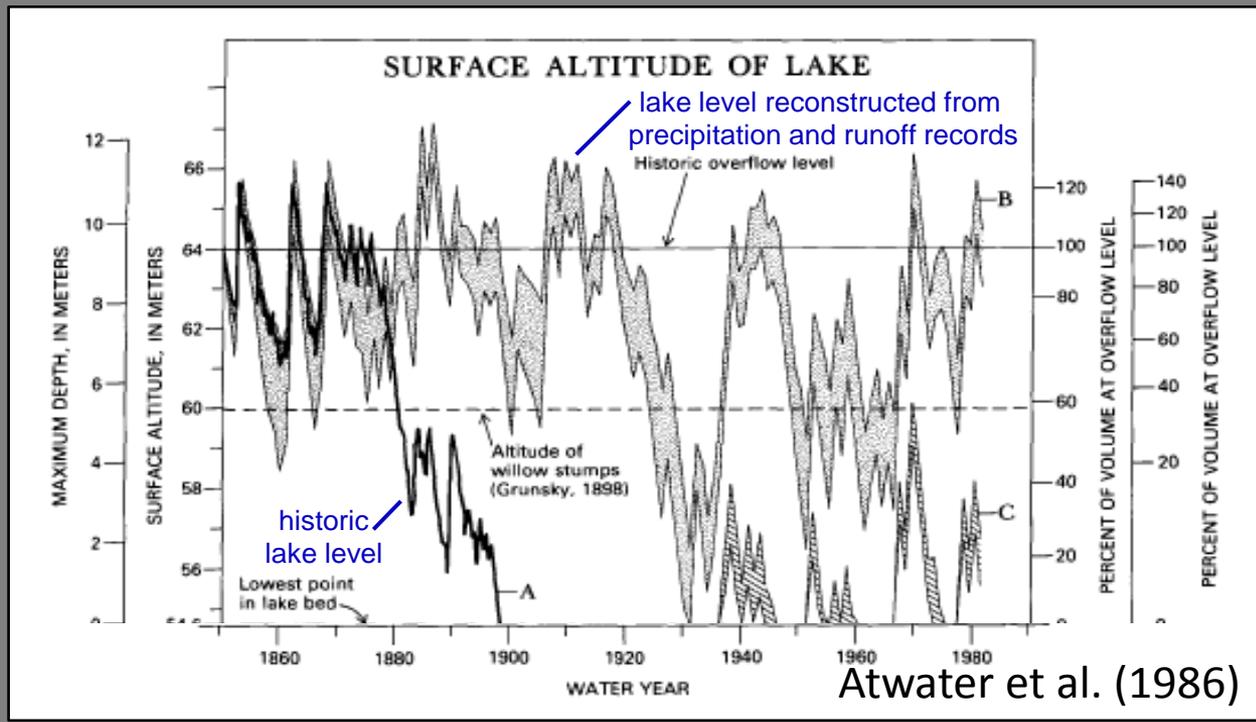
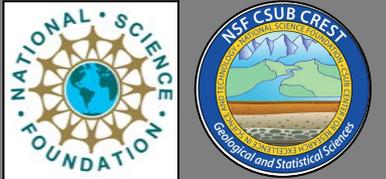


Toward a Sierran stream discharge forecast based on Tulare Lake-level reconstruction

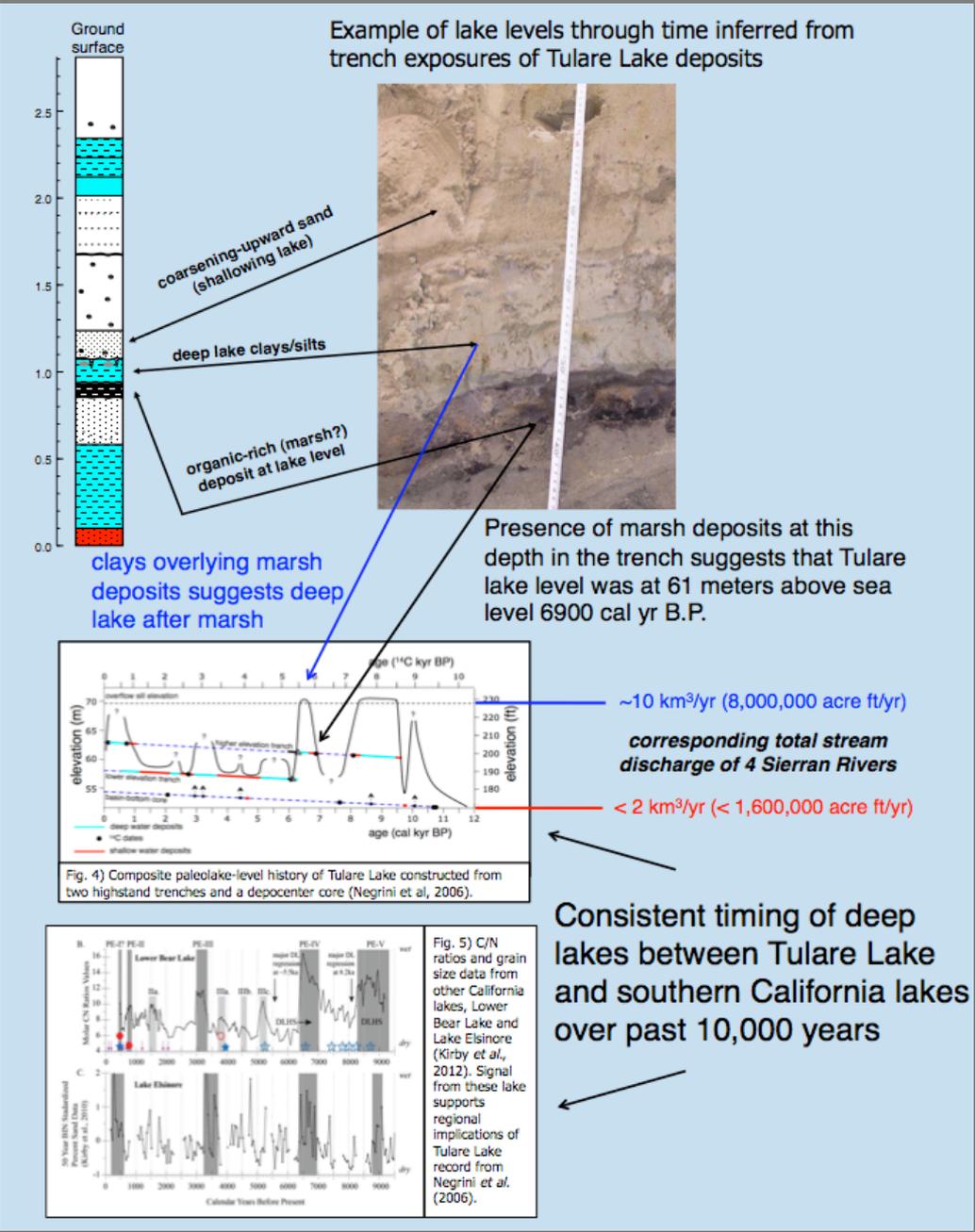


The surface elevation of Tulare Lake changes with stream discharge from Sierran Rivers



..... Tulare Lake levels are essentially a stream gauge for the southern Sierra Nevada recharge into the San Joaquin Valley, one of the most important agricultural centers in the world

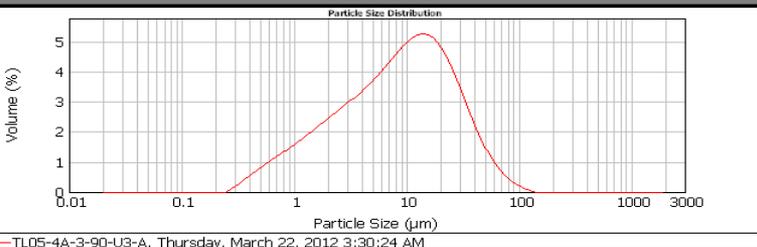
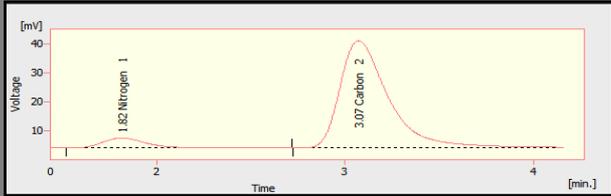
Previous Work based on trench mapping



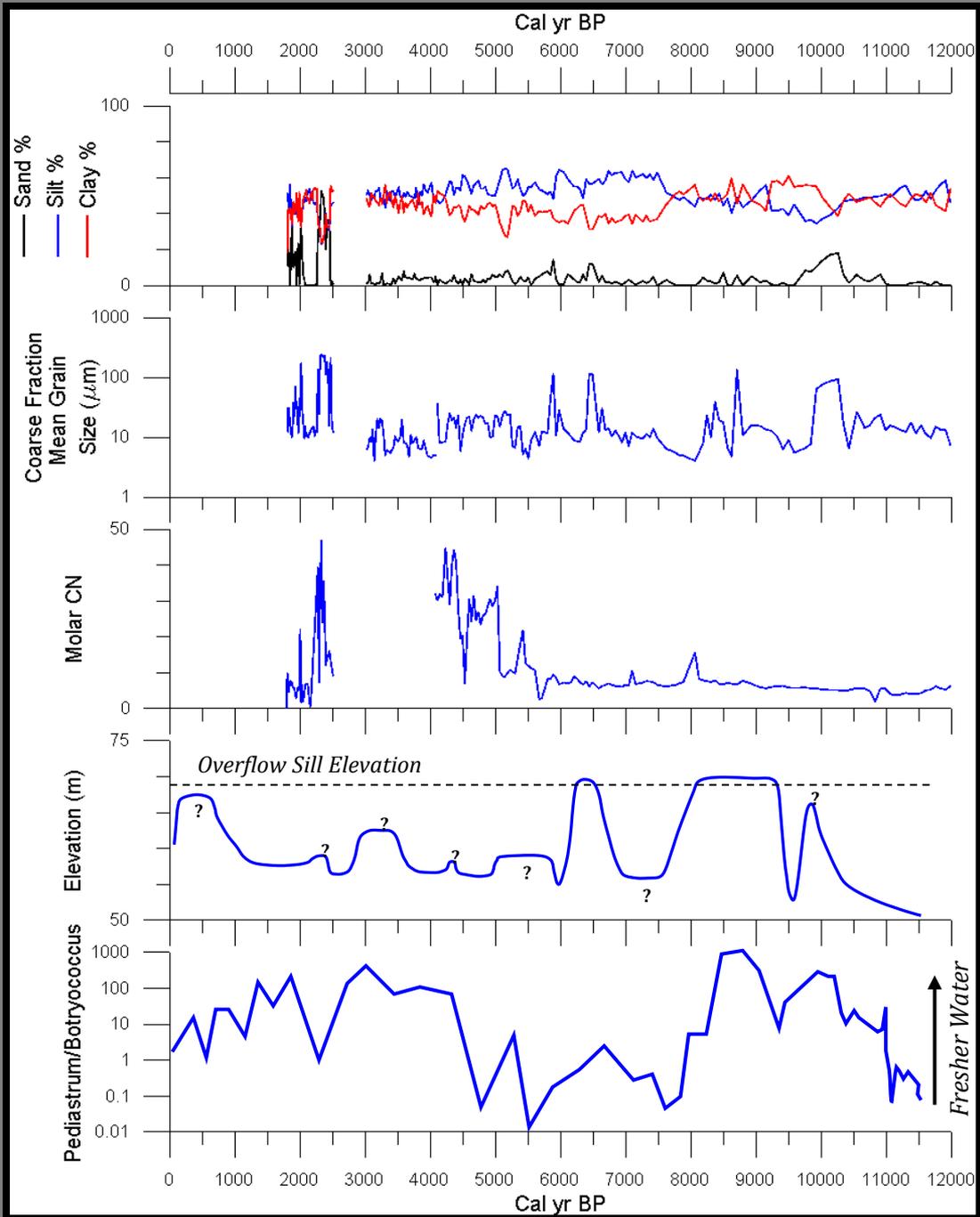
Consistent timing of deep lakes between Tulare Lake and southern California lakes over past 10,000 years

Work in progress:

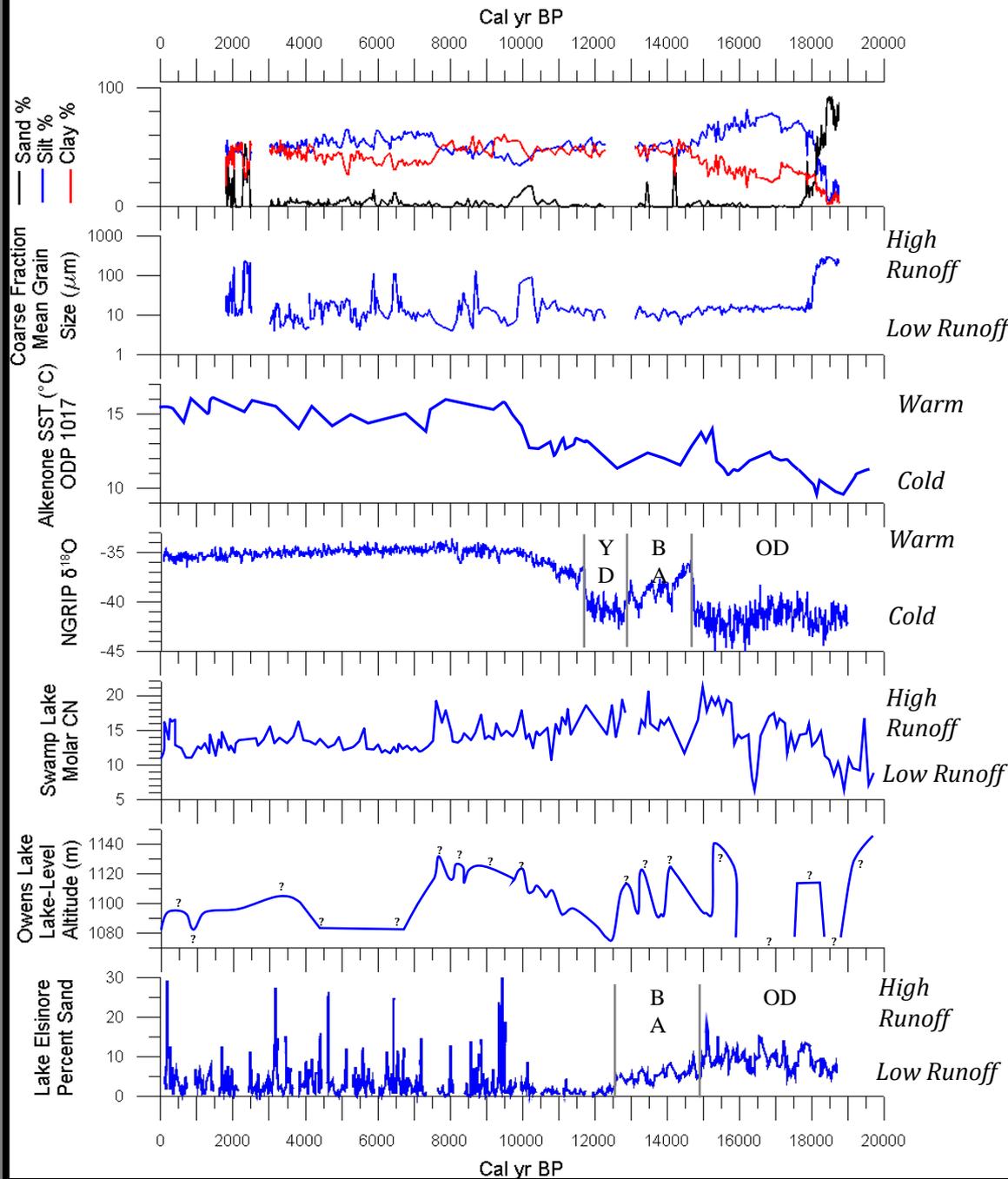
Proxy data from cores compared to previous Tulare Lake records



TL05-4A-3-90-U3-A, Thursday, March 22, 2012 3:30:24 AM



.....compared to other paleoclimate records



Sand, silt, and clay content of Tulare Lake TL05-4A core

Coarse grain fraction of Tulare Lake TL05-4A core

Alkenone SST for ODP 1017E (Kiefer, 2013)

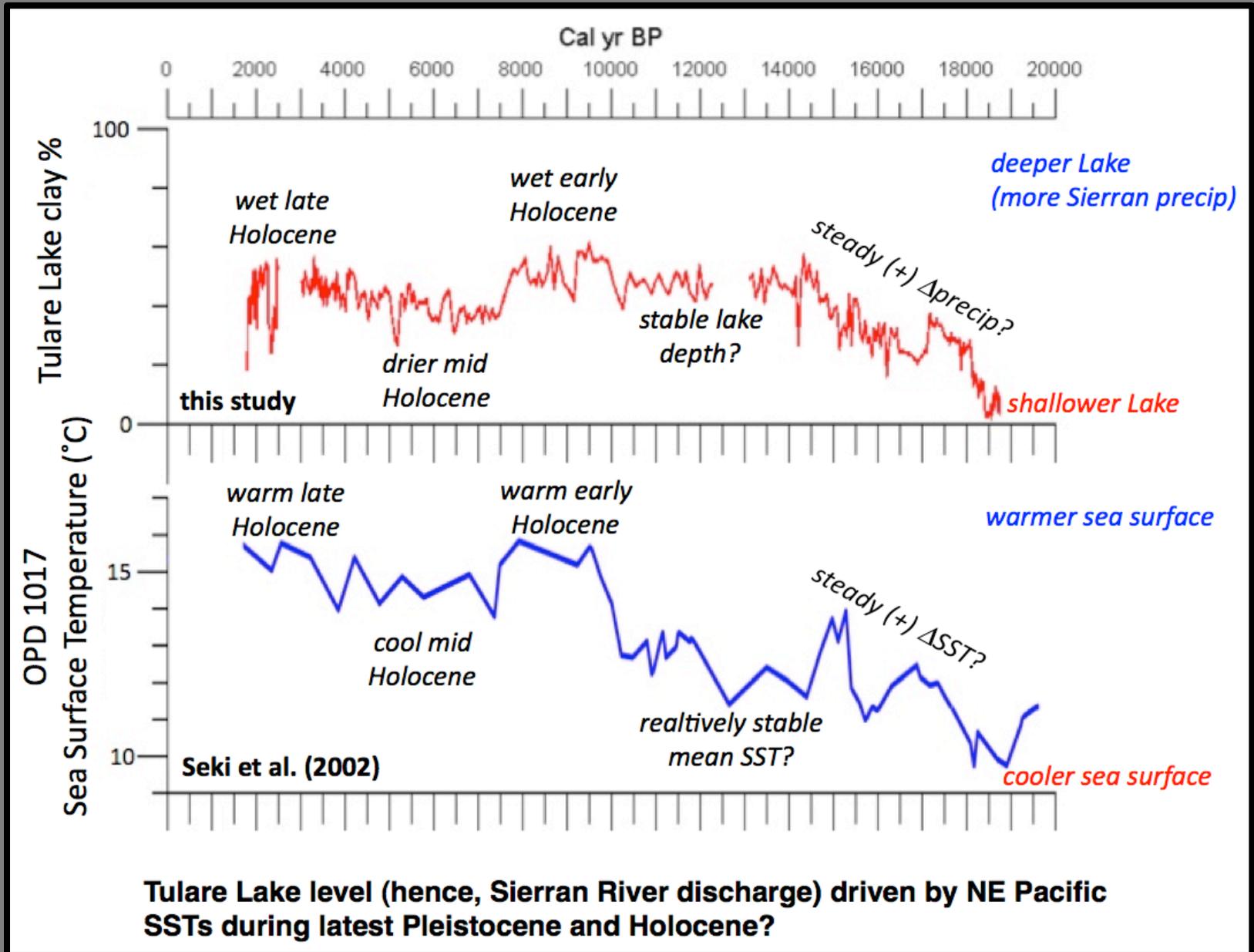
NGRIP oxygen isotope data (Andersen et al., 2006; Rasmussen et al., 2006),

Molar CN data for Swamp Lake, CA (Street et al., 2012),

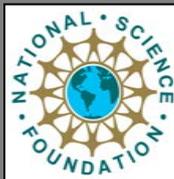
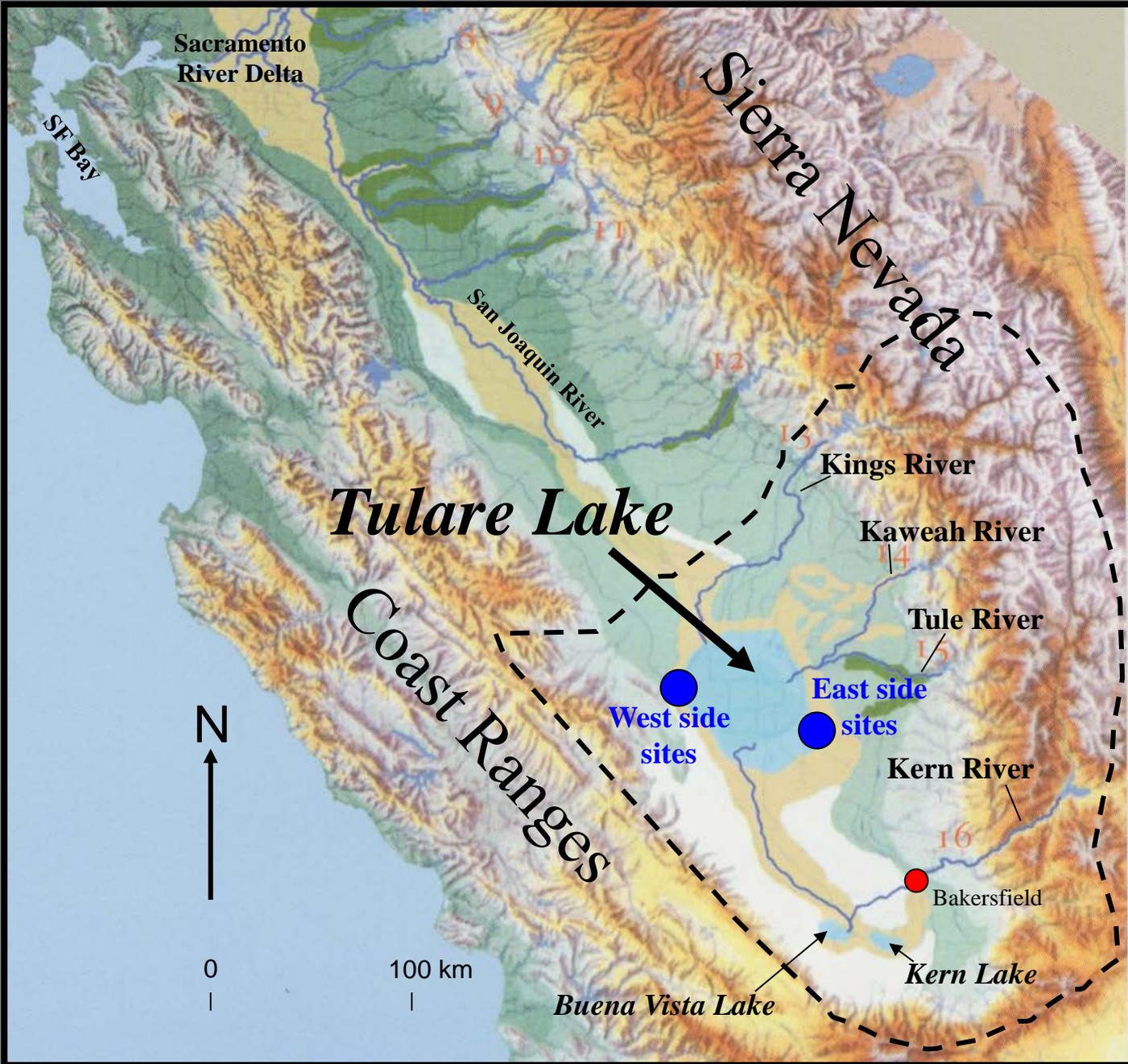
Lake-level elevation for Owens Lake, CA (Bacon et al., 2006), and

Sand content data for Lake Elsinore, CA (Kirby et al., 2010; after Kirby et al., in press).

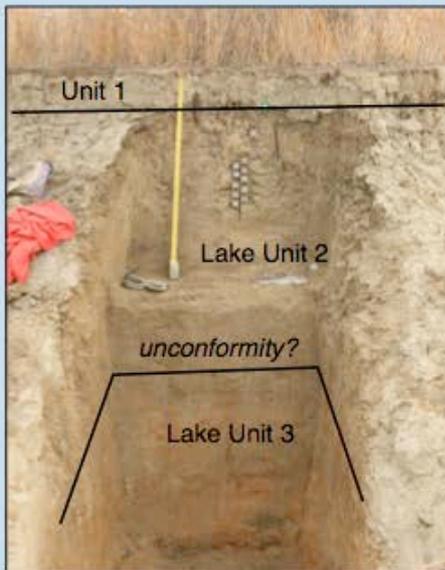
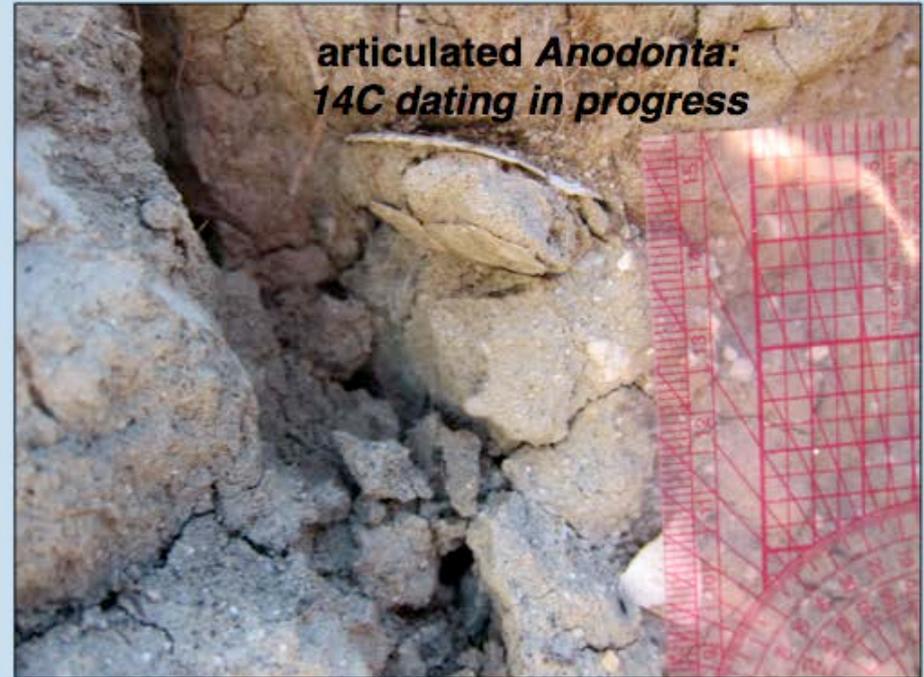
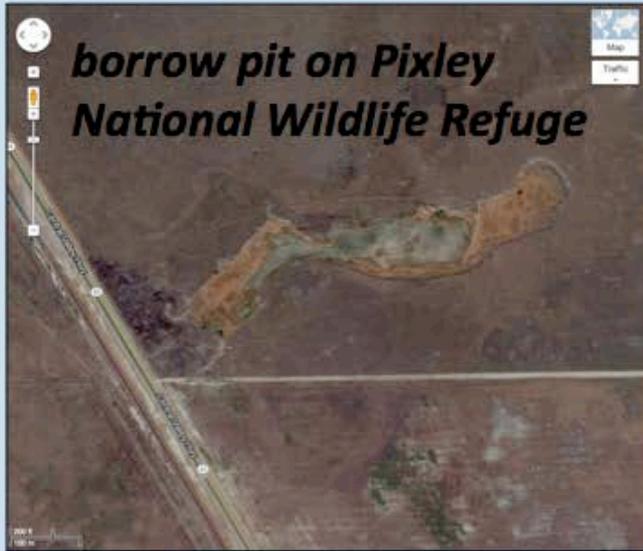
Tulare Lake-level and temperature of surface water in NE Pacific



Future Work: Past 1,000 yr



Pixley National Wildlife Refuge



***Initial excavations in
PNWR borrow pit:
Detailed record of
most recent 1000 yrs?***



BLM Atwell Island Restoration Project

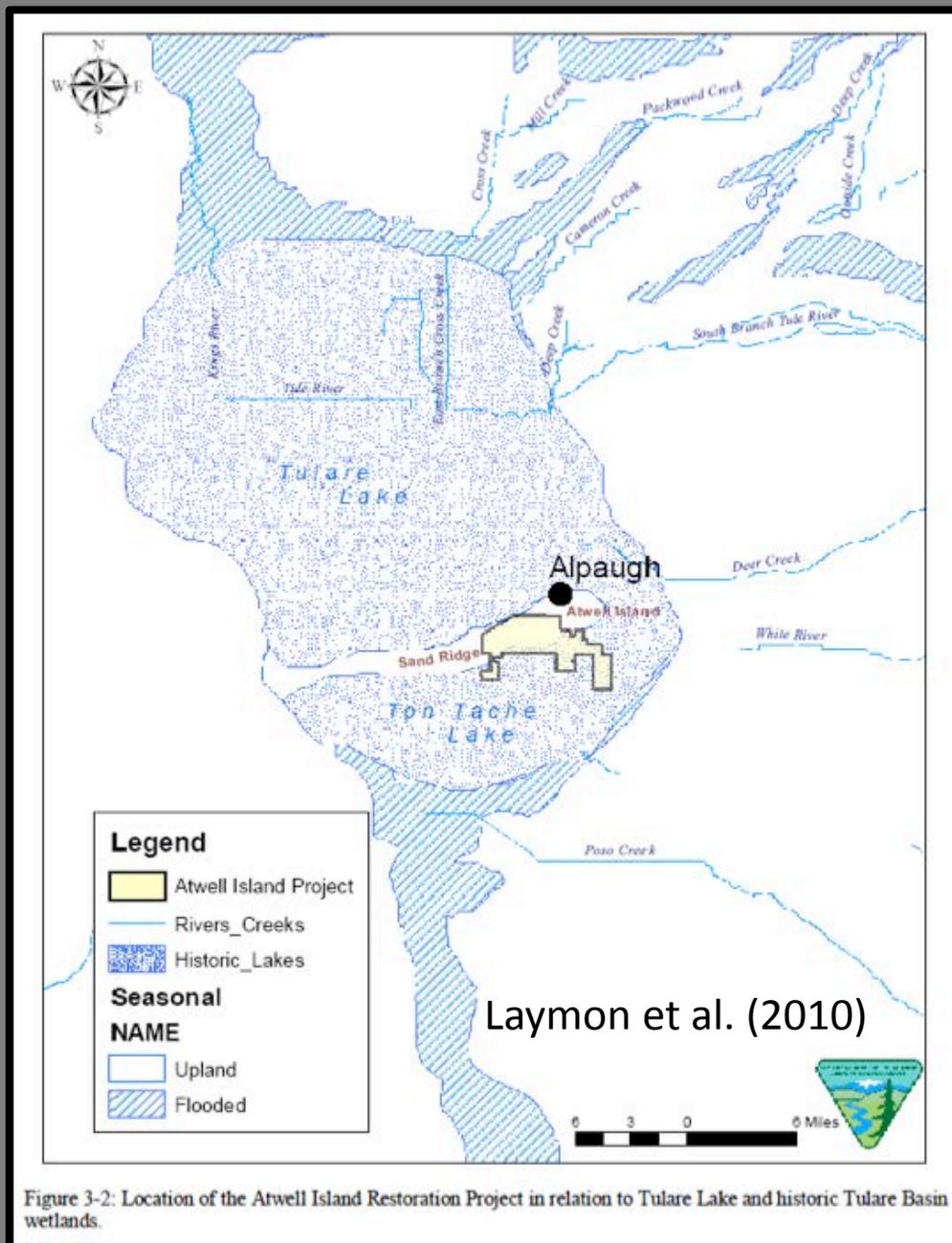
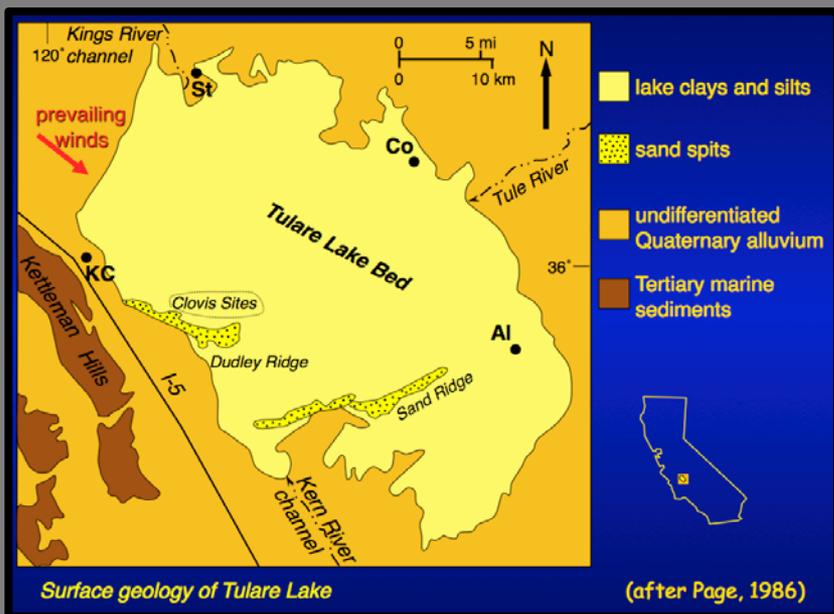
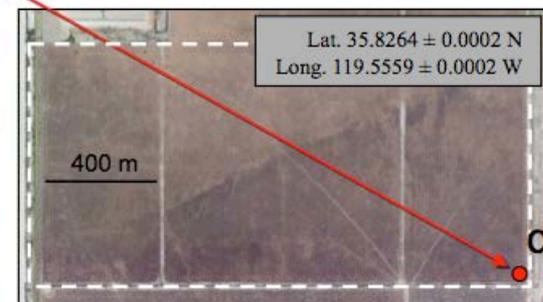
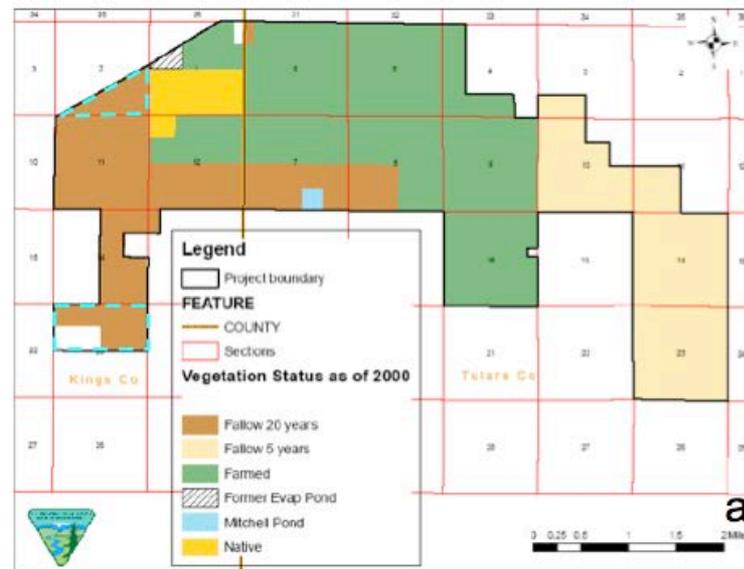
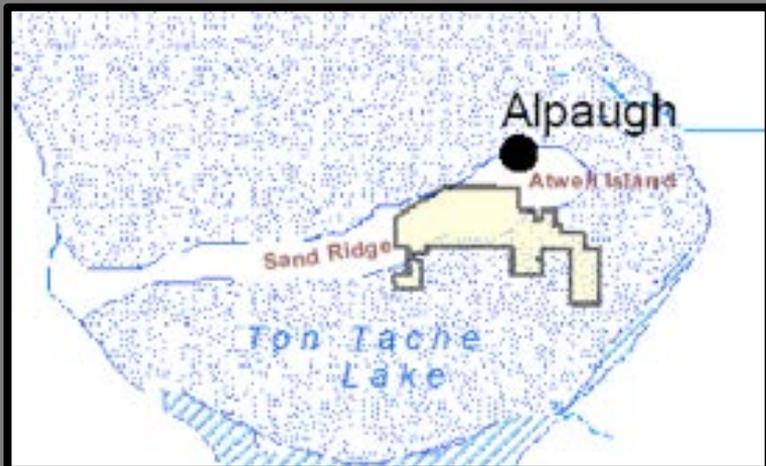
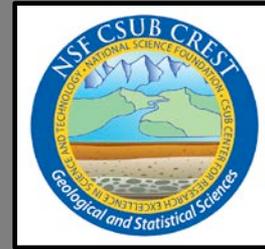


Figure 3-2: Location of the Atwell Island Restoration Project in relation to Tulare Lake and historic Tulare Basin wetlands.

BLM Atwell Island Restoration Project



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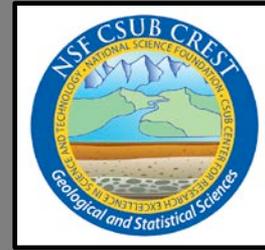


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CALIFORNIA
STATE
UNIVERSITY,
FRESNO

To: National Science Foundation

From: Dr. David Zoldoske, Director
California Water Institute
California State University, Fresno

Date: April 8, 2011

Re: Letter of Support for California State University, Bakersfield

I am pleased to offer our support for the NSF funding request submitted by Dr. Robert Negrini. The proposed study addresses lake-level/run-off estimates for Tulare Lake from a historical perspective. When completed, I believe this study would provide valuable insight concerning the impact of climate change and run-off variability from the southern Sierra-Nevada mountain range, which is a critical part of the Tulare Water Basin.

Additionally, the proposed study will provide valuable background information to the development of the Integrated Regional Water Management Plan (IRWMP) now being developed by the California Water Institute. The IRWMP is focusing on the eight county region beginning with Kern in the south and ending with San Joaquin in the north.

Seven of the eight counties in San Joaquin Valley IRWMP are among the top agricultural counties in the United States, producing nearly \$20 billion in farm gate receipts in 2009. Nearly all of this production is dependent on water for irrigation. A better understanding on the potential variability of future water supplies will provide a critical input to our planning process.

For our part, our Institute will serve the CSUB CREST center as a resource, linking them as appropriate with the contacts we've made and data we've gathered regarding water resources over the years (e.g., farmer's, water purveyors, stream discharge readings). We will also provide direct expertise for tasks such as serving as thesis readers and informal consultation on laboratory and field procedures.

California Water Institute
6014 North Cedar Avenue MS 0718
Fresno, CA 93710
559.298.6072
Fax 559.298.3576
www.californiawater.org

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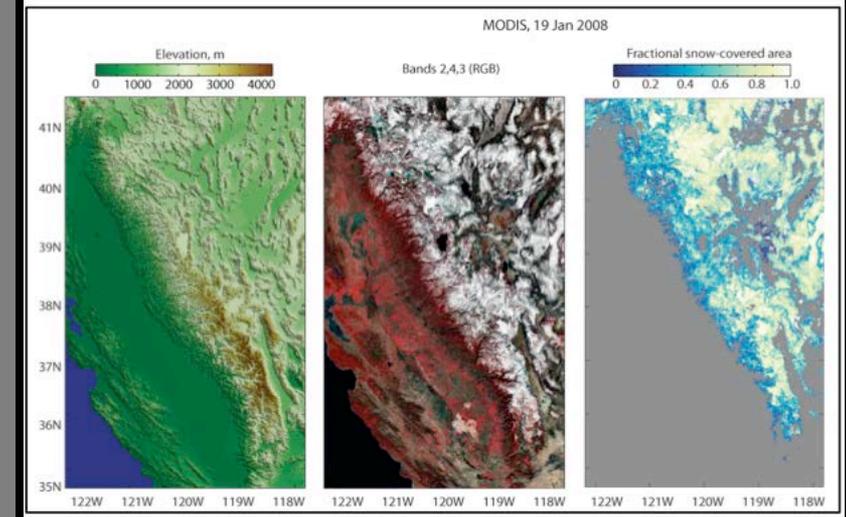
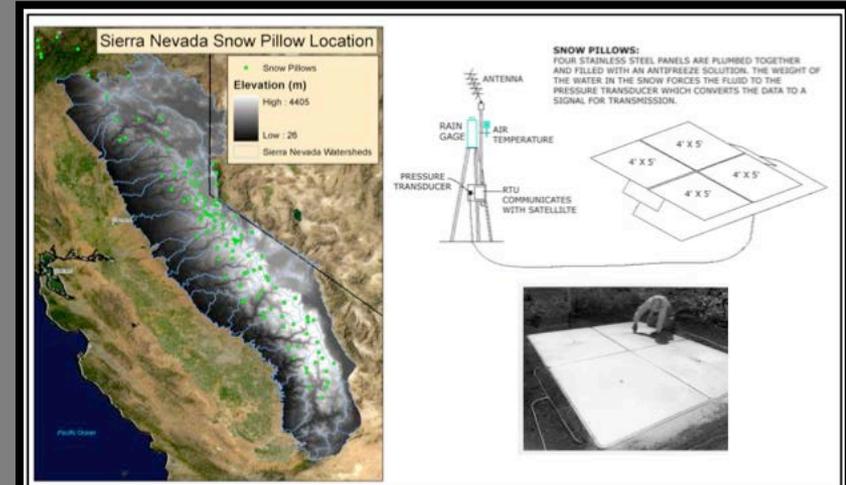
CSUB NSF CREST

Statistical analyses of Sierran snowpack response to historic climate change



1. Forecast timing and amount of water delivery to SJV from Sierra by statistical analyses of snowpack

- Two undergraduate students recruited and "spinning up" w.r.t. linear algebra, computer programming, data management and non-parametric regression
- Both progressed to Ph.D. programs.





CSUB NSF CREST

Carbon Capture and Sequestration



Carbon Capture and Sequestration in the Monterey Stevens Sandstone, San Joaquin Valley California



Jonathan Goodell, Janice Gillespie, 2012, California State University Bakersfield Department of Geological Sciences

Project Description

To test the hypothesis that the Stevens Sandstone reservoir at the North Coles Levee oil field satisfies the criteria for injection of CO₂ set forth by Burress et al. because a. it exceeds the minimum storage capacity of 12.5 million barrels of cumulative production and b. its depth is sufficient to maintain injected CO₂ in a supercritical phase. Tectonic subsidence of the San Joaquin Basin, growth of the NCL anticline, and eustatic sea level changes influenced the distribution of the sandstone reservoirs deposited in a series of turbidite complexes during late Miocene time². The modern reservoirs are hypothesized to be a series of stacked sand channels and lobes encased in shale². Accordingly, reservoirs at NCL have trapped buoyant fluids (oil and gas) for thousands to millions of years providing evidence of their sealing characteristics that will likely allow CO₂ storage for the foreseeable future² (Figure 1). Despite the above assurances, the degree of compartmentalization in the Stevens sandstone reservoirs at NCL is simply not yet known sufficiently, nor is the degree to which pressure support is provided by the adjacent aquifer³. This project sets out to answer these questions.



Location

North Coles Levee is located midway between Bakersfield and Taft adjacent to Interstate 5 in Kern County California (Figure 2). The fields structure and major trapping mechanism is an anticline some similar neighboring west side oil fields Elk Hills and Buena Vista⁴ (Figures 3,5).

Figure 1. Location of North Coles Levee oil field

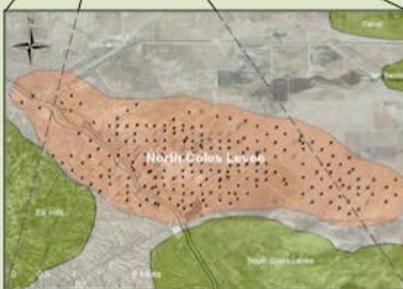


Figure 2. North Coles Levee in relation to nearby fields

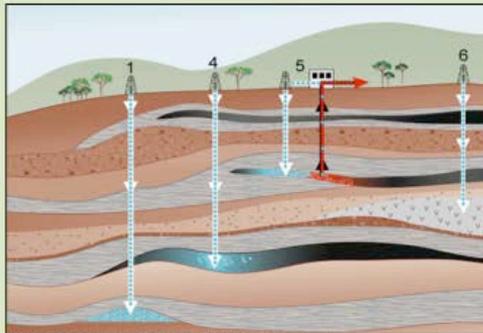


Figure 3. Idealized Cross section showing both CO₂ storage and CO₂ Enhanced Oil Recovery (EOR) (http://www.eprtechnology.com/Content/Research/StorageDetail.asp?ID=289)

NSF CSUB CREST

Funding for this project is provided by CREST. In 2011 California State University Bakersfield received a 5 million dollar grant from the National Science Foundation (NSF) to establish the Center for Research Excellence in Science and Technology (CREST). The two primary goals of CREST are 1. Project future water resources from the Sierra Nevada over the next several decades and 2. Evaluate the suitability for CO₂ storage in local mature oil reservoirs. The majority of CREST research projects will be conducted by both Masters and Undergraduate students recruited from the Bakersfield, an area that has been poorly represented in the sciences⁵.

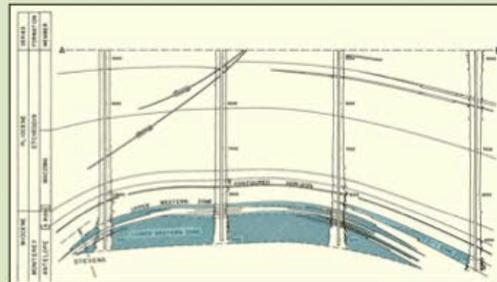


Figure 4. South-North (A-B) cross section of North Coles Levee (DOOGUE, 1962, 2009)

References

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- Goodell, J. 2012. *North Coles Levee Oil Field Carbon Dioxide Storage in a Mature Field*. Master's Thesis, Department of Geological Engineering and Mining, May 20, 2012.
- Harwood, H.E. 1962. North Coles Levee Oil Field, California. Division of Oil and Gas, Bureau of Geology, Vol. 46, No. 2.
- The National Science Foundation, 2011. Award Abstract #1117716.
- CREST Center for Research Excellence in Science and Technology

Research Plan

- Gather porosity and electric log data from well logs and fluid production and pressure data from well records (Figure 6).
- Produce a GIS database including annual production and injection values.
- Account for all fluids produced and volume changes that occurs when fluids are pumped to the surface
- Utilize pressure measurements from all wells, drill stem tests and production tests as a reverse analog to determine how the formation will react to injection of CO₂.
- Utilize geologic interpretation software (e.g., PetraTM, and PetrelTM) to build a 3D geologic model in order to access net sand, reservoir geometry (compartmentalization), cross sections, and total reservoir volume (Figures 4,5).
- Produce a plot of pressure vs. net fluid production to determine the effect of water drive on the reservoir.
- Summarize findings in masters thesis and present at society meetings, community events, and K-12 outreach events.

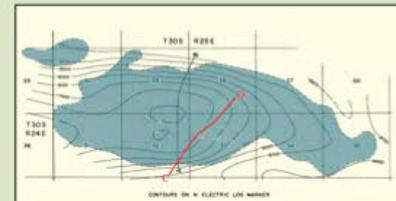


Figure 5. Net sand structure contour map showing the total sand volume of the Stevens Reservoir at North Coles Levee (DOOGUE, 1962, 2009)

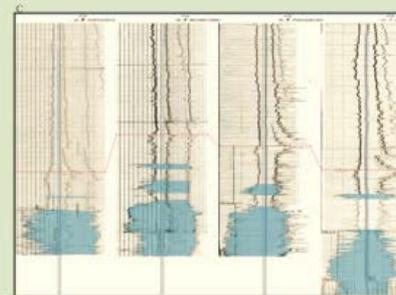


Figure 6. North Coles Levee electric logs, red line, N-study well logs, blue shaded areas, Stevens Reservoir

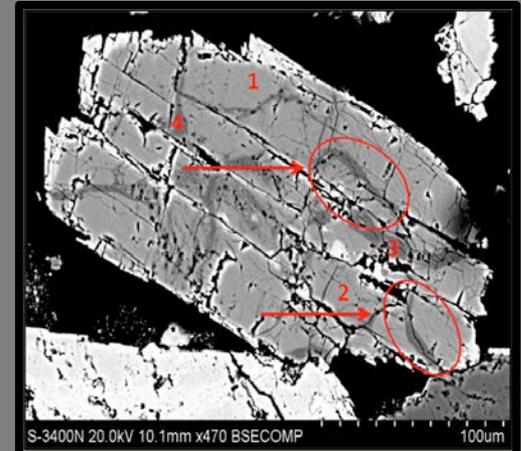
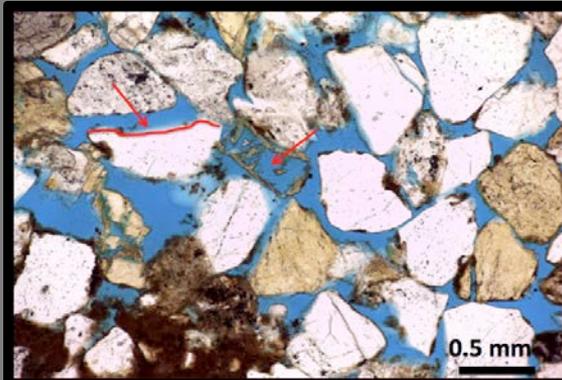
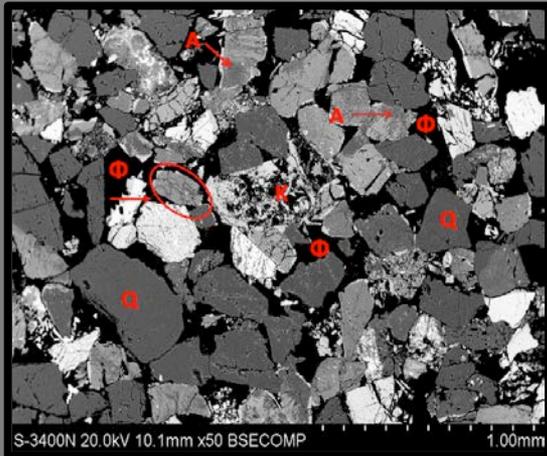
Acknowledgements

Funding from the National Science Foundation, NSF DMR CREST Award # 1117716, makes this research possible. The Geological Society of America, for additional funding, Acknowledgement for software training, Abraham Chavez and Justin Alford for data acquisition, Dr. Jan Gillespie and Dr. Rob Nigh for advice, encouragement and knowledge.

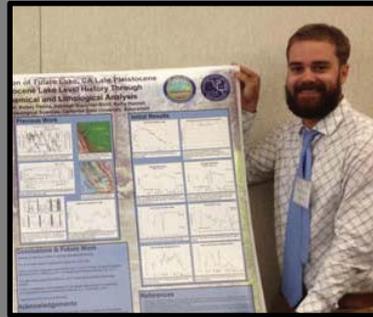


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Carbon Capture and Sequestration



\$25,000 of WRPI USDA support leveraged with NSF CREST funds to support 25 CSUB students



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