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The Bear River's Diversion and the Cutting of Oneida Narrows at ~55-50 ka and Relations to the Lake Bonneville Record

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ABSTRACT

The Bear River's course has shifted over Quaternary time, and its late Pleistocene integration into the Bonneville basin long has been recognized as a possible explanation for why Lake Bonneville was apparently larger than the preceding lakes in its basin, and the only one to overflow its topographic threshold.

The middle-Pleistocene Bear River joined the Snake River to the north, likely via the Portneuf River drainage. Then an episode of volcanism in the Blackfoot-Gem Valley volcanic field ~100–50 ka diverted the Bear River southward into Gem Valley. Previous chronostratigraphic and isotopic work on the Main Canyon Formation in southern Gem Valley indicates internal-basin sedimentation during most of the Quaternary, with a possible brief incursion of the Bear River ~140 ka. New evidence confirms that the Bear River's final diversion at ~55 ka led to its integration into the Bonneville basin by spill-over at a paleo-divide above present-day Oneida Narrows dam. This drove rapid incision of 200 m of bedrock in the canyon and excavation of southern Gem Valley in the subsequent millennia, before the rise of Lake Bonneville back flooded the area, as constrained by new optically stimulated luminescence dates above, within, and below the canyon.

Bear River integration into the Bonneville basin early during marine isotope stage 3 seems to postdate the Cutler Dam lake cycle, although that penultimate pluvial lake is incompletely dated and understood. It is also possible the Bear River's hydrologic addition relates to the recently recognized but poorly constrained Pilot Valley shoreline that predates the main Bonneville lake cycle. Regardless, the Bear River certainly contributed to the rise of Lake Bonneville, culminating in the Bonneville flood.

This content is a PDF version of the author's PowerPoint presentation.

The Bear River's diversion, the cutting of Oneida Narrows at 55-50 ka, and relations to the Lake Bonneville record

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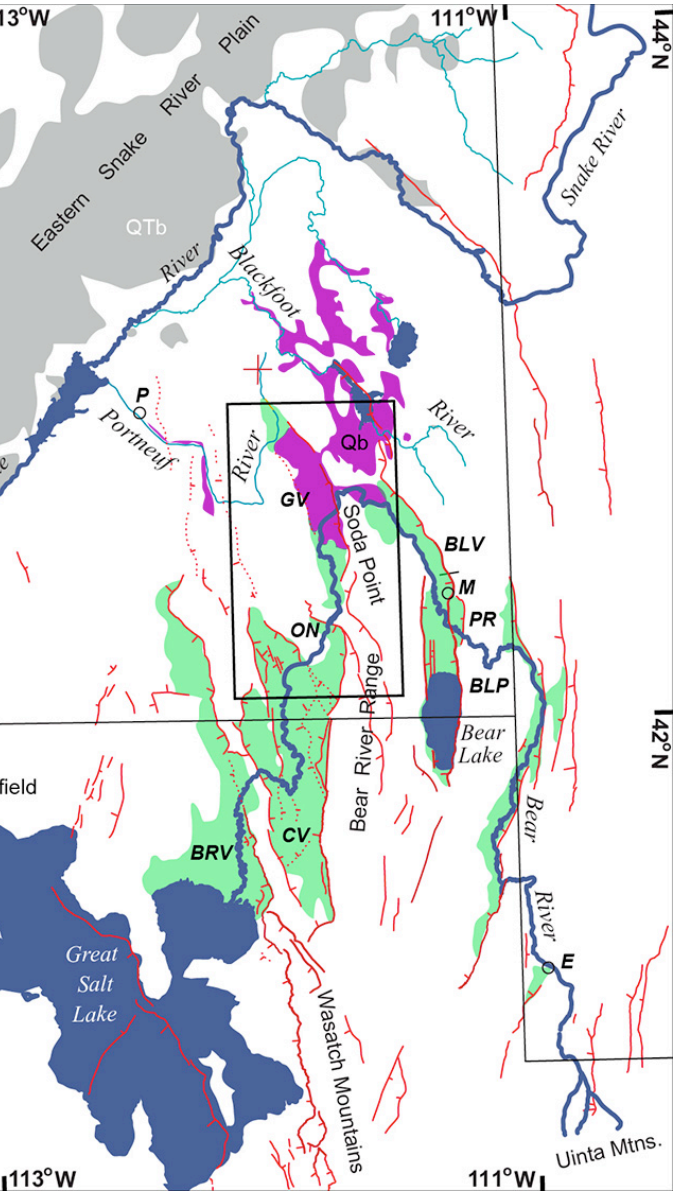
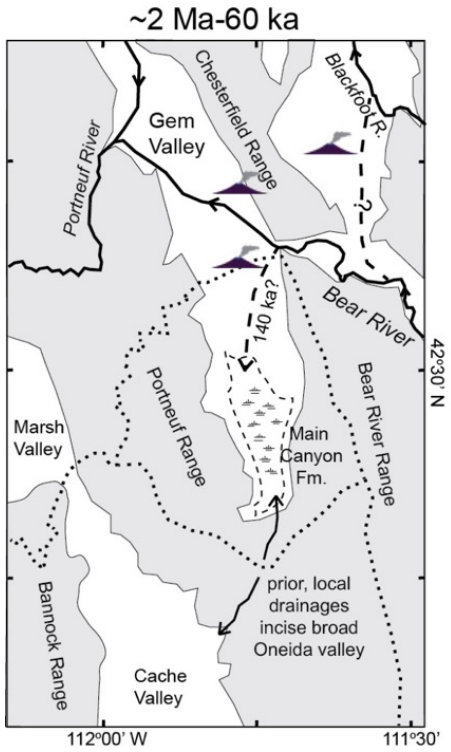
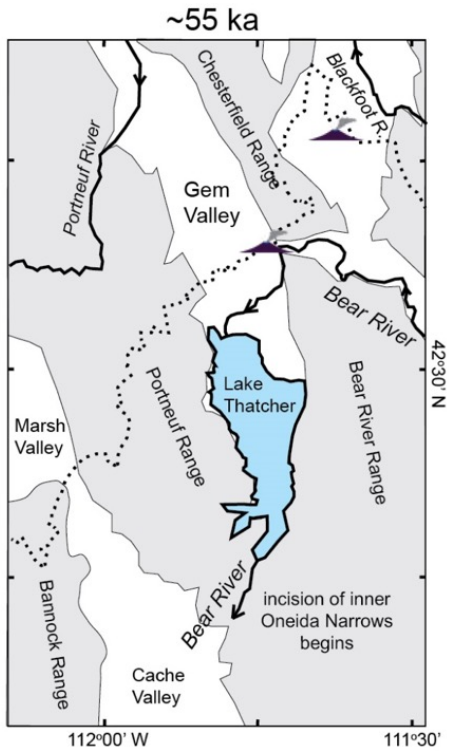
Utah State University
DEPARTMENT OF GEOLOGY

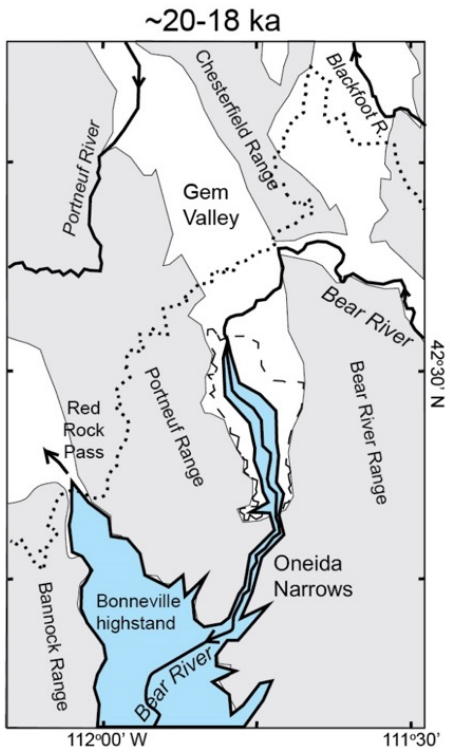
1. Review of knowledge about Bear River's history and diversion
2. Evidence for river integration at ~55 ka
3. Rapid cutting of Oneida Narrows in subsequent millennia
4. Relations to the Lake Bonneville record

THIS TALK = virtual field trip


13°W
111°W
44°N
42°N
113°W
111°W
Eastern Snake River Plain
QTb
Snake River
Blackfoot River
Portneuf River
P
Qb
GV
Soda Point Range
BLV
M
PR
ON
BLP
Bear River Range
Bear Lake
CV
BRV
Bear River
E
Great Salt Lake
Wasatch Mountains
Uinta Mtns.

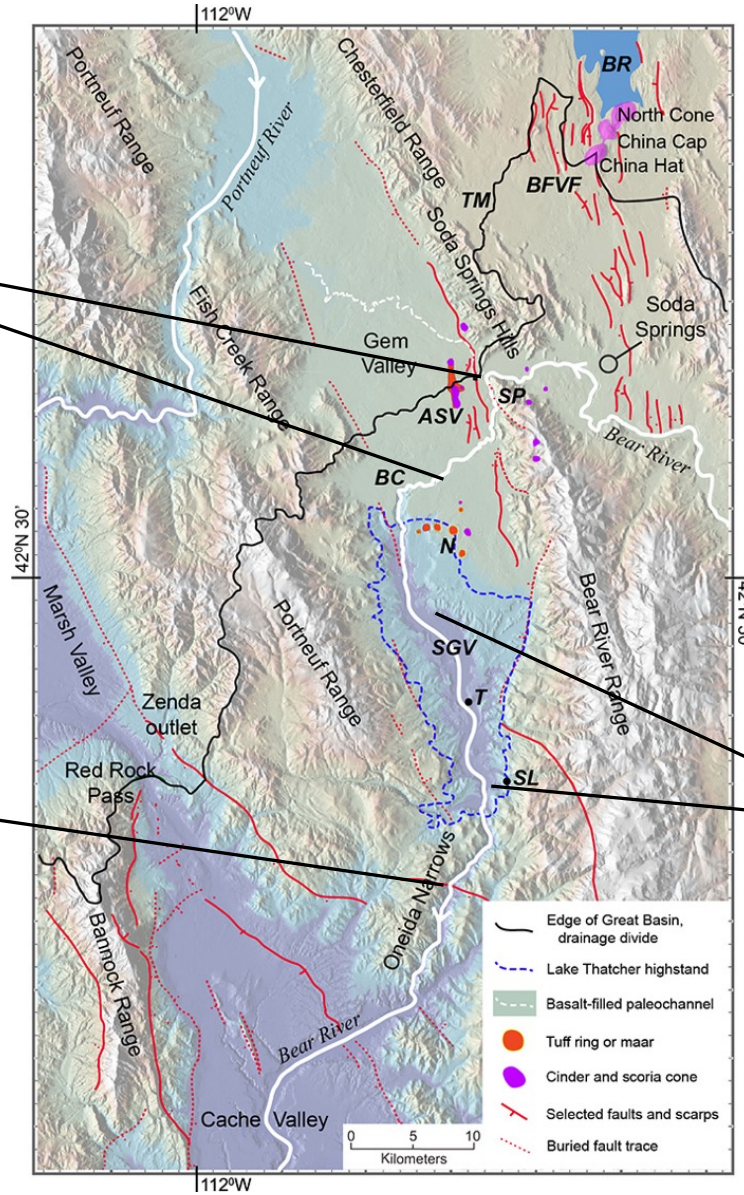

~2 Ma-60 ka
Gem Valley
Chesterfield Range
Blackfoot R.
Portneuf River
~140 ka ?
Bear River
Portneuf Range
Bear River Range
Main Canyon Fm.
Marsh Valley
prior, local drainages incise broad Oneida valley
Bannock Range
Cache Valley
42°30' N
112°00' W
111°30'


~55 ka
Gem Valley
Chesterfield Range
Blackfoot R.
Portneuf River
Bear River
Lake Thatcher
Portneuf Range
Bear River Range
Marsh Valley
Bear River
incision of inner Oneida Narrows begins
Bannock Range
Cache Valley
42°30' N
112°00' W
111°30'


~20-18 ka
Gem Valley
Chesterfield Range
Blackfoot R.
Portneuf River
Bear River
Red Rock Pass
Portneuf Range
Bear River Range
Oneida Narrows
Bonneville highstand
Bannock Range
Bear River
42°30' N
112°00' W
111°30'

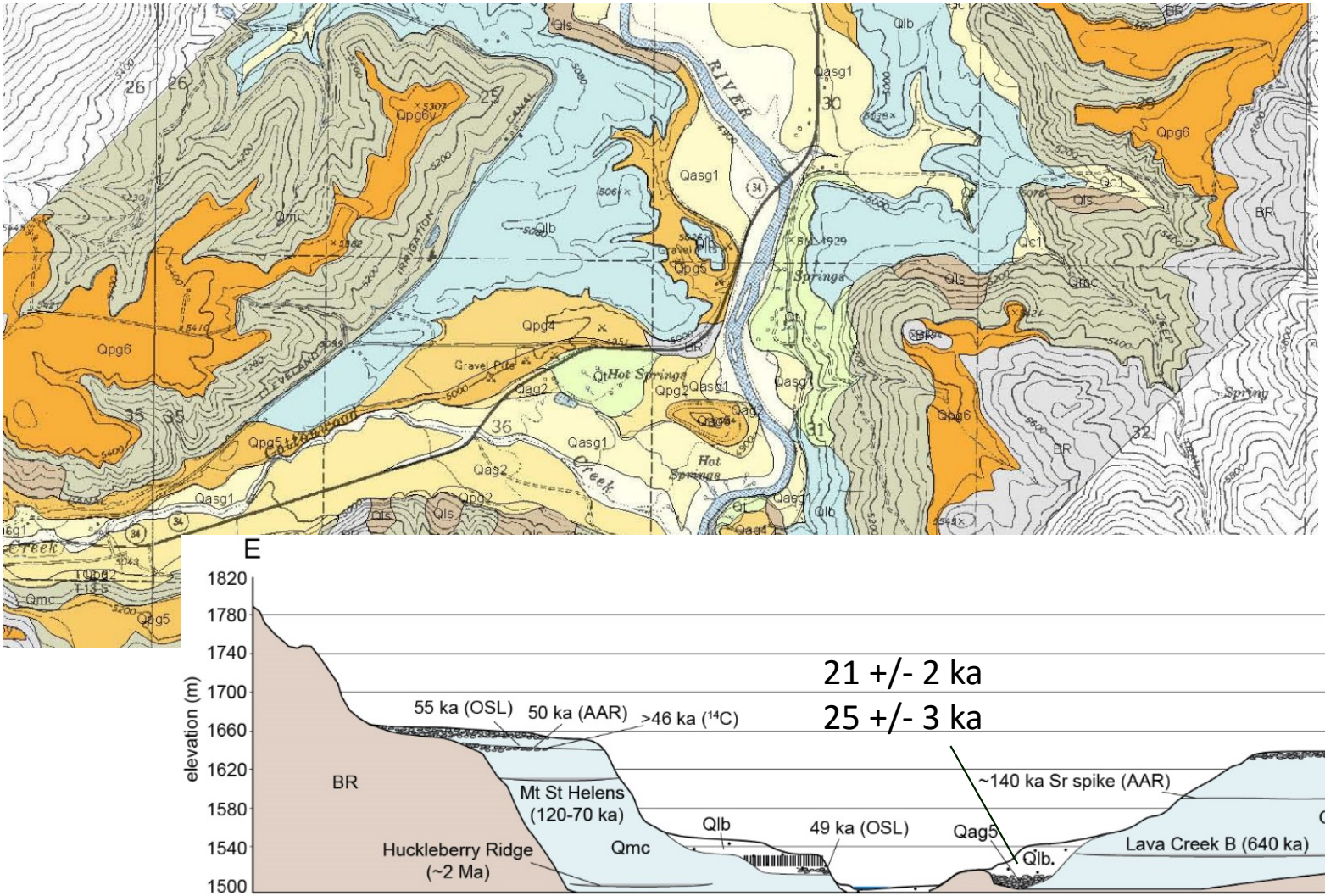
Soda Point
Black Canyon

Oneida dam
paleodivide



X-section Main Canyon Fm.
Smith locality
Sant Road outcrop

1. Review of knowledge about Bear River's history and diversion



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2. Evidence for river integration at ~55 ka

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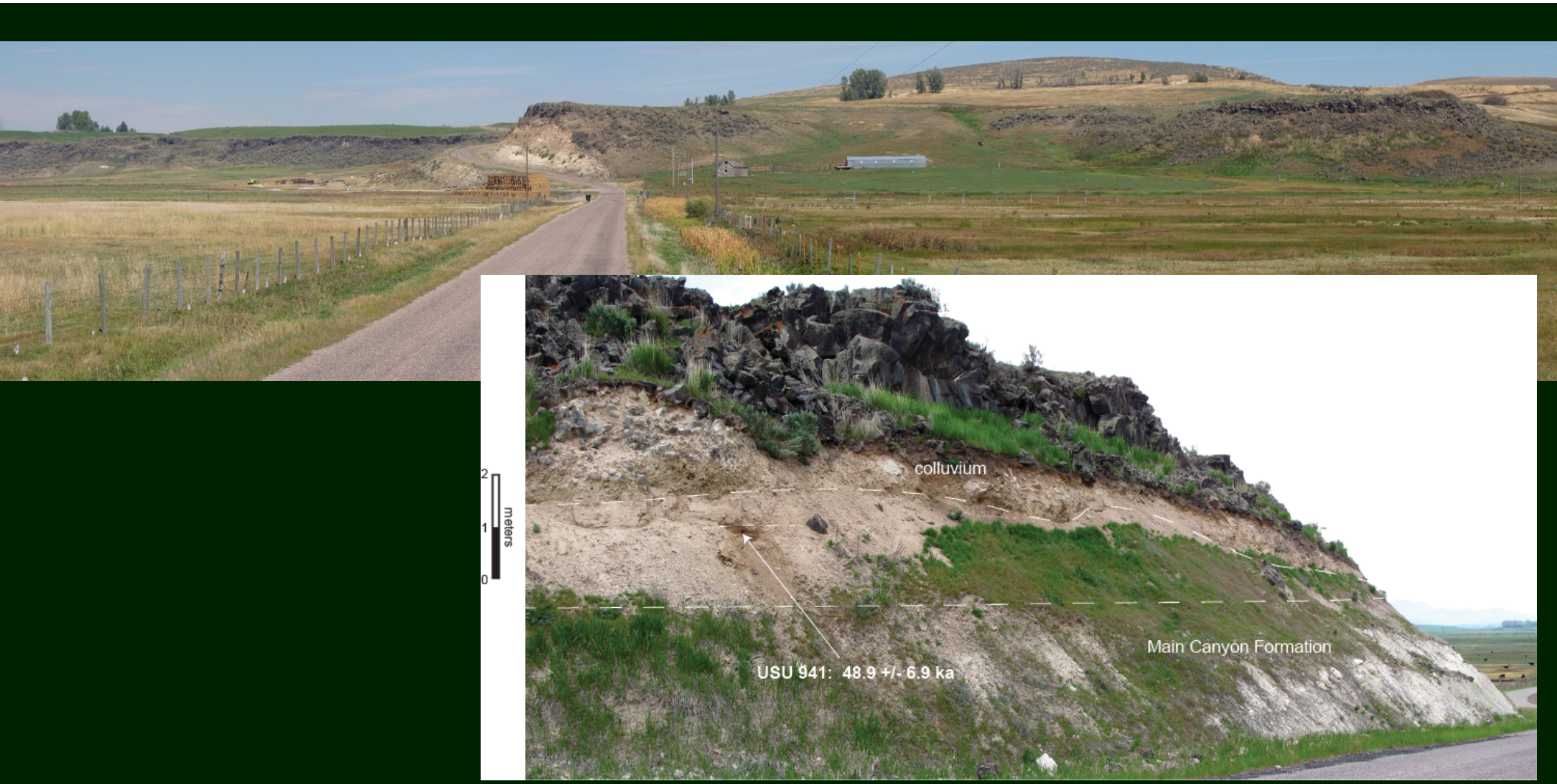
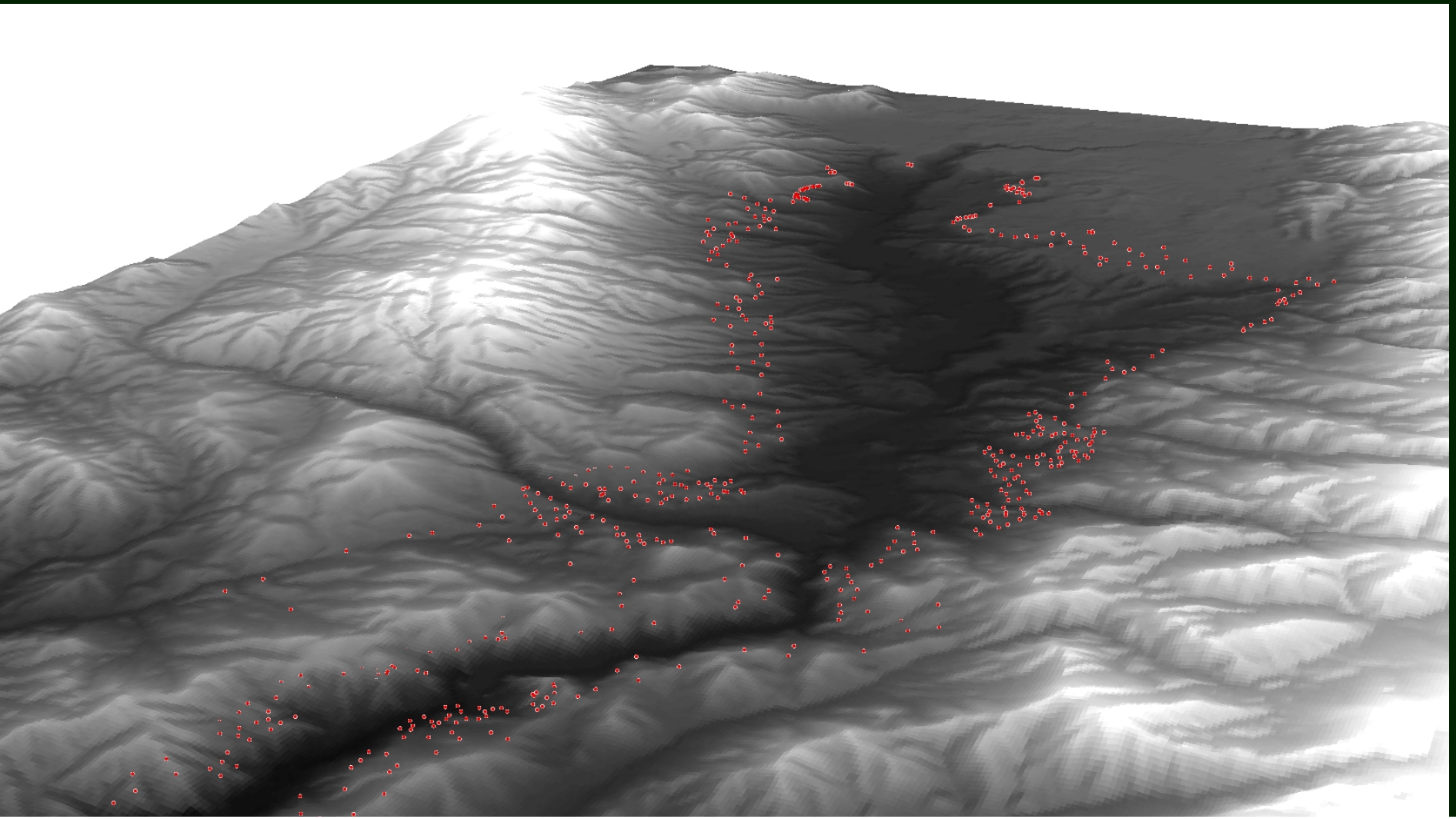


3. Rapid cutting of Oneida Narrows in subsequent millennia

Reconstruction of basin topography prior to diversion



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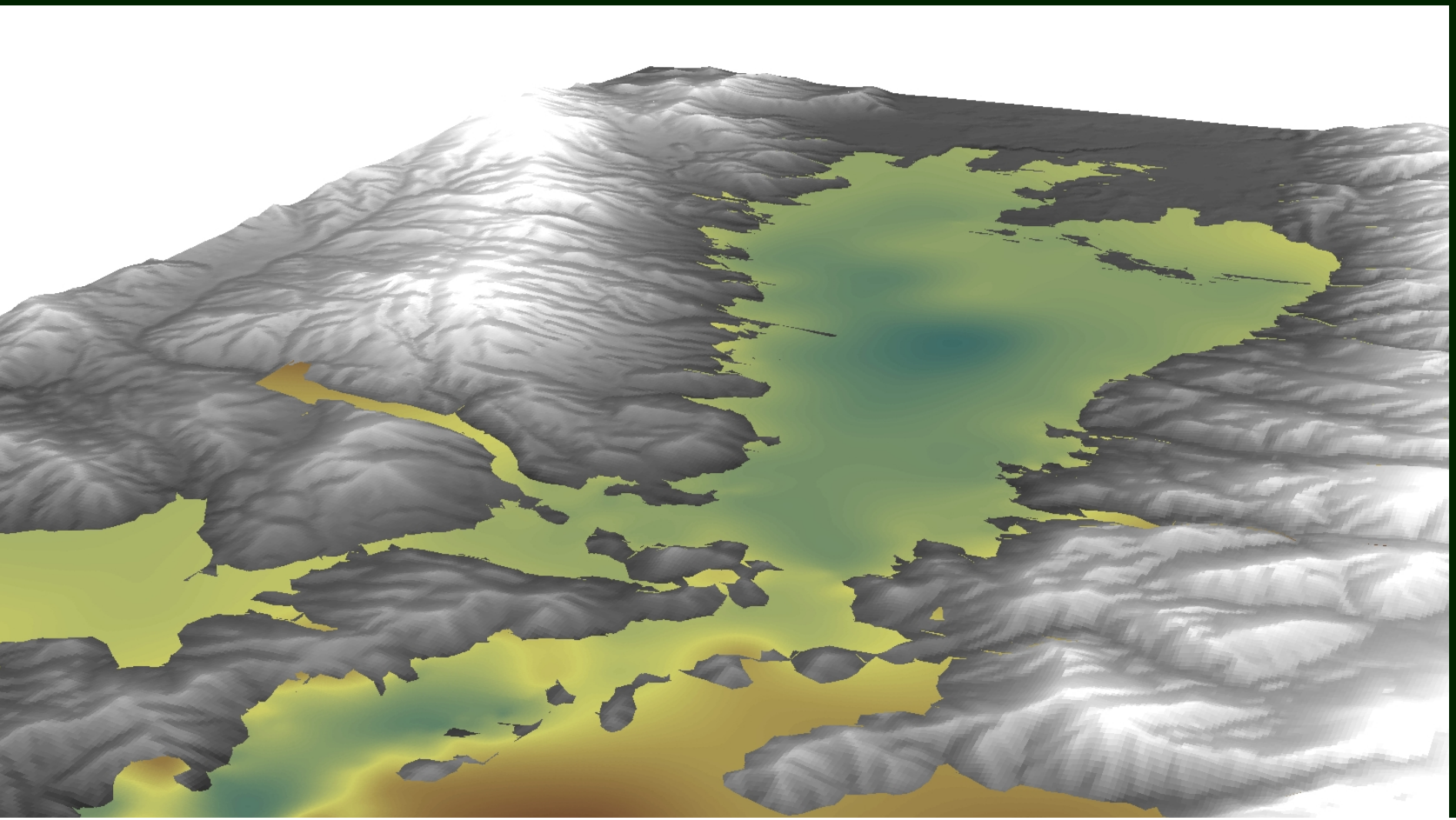

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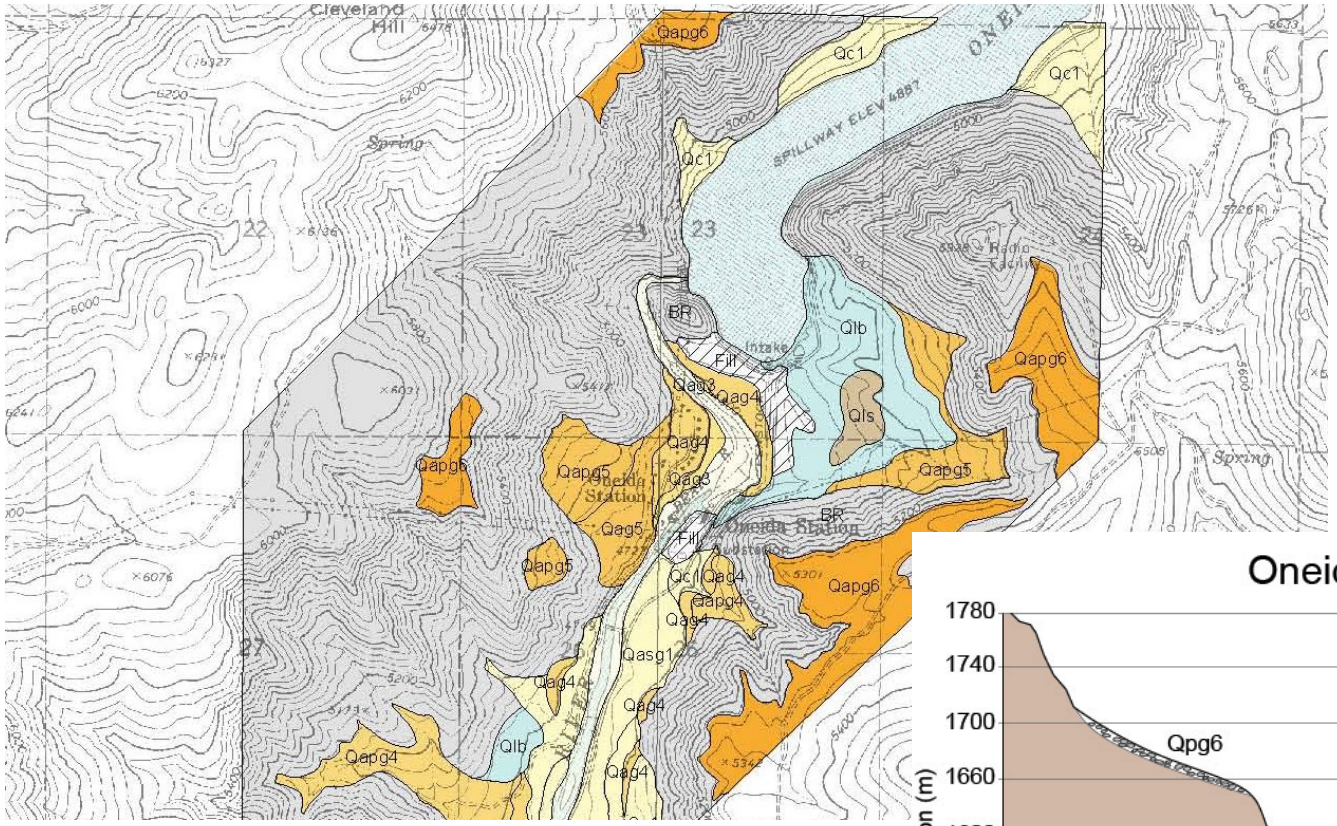

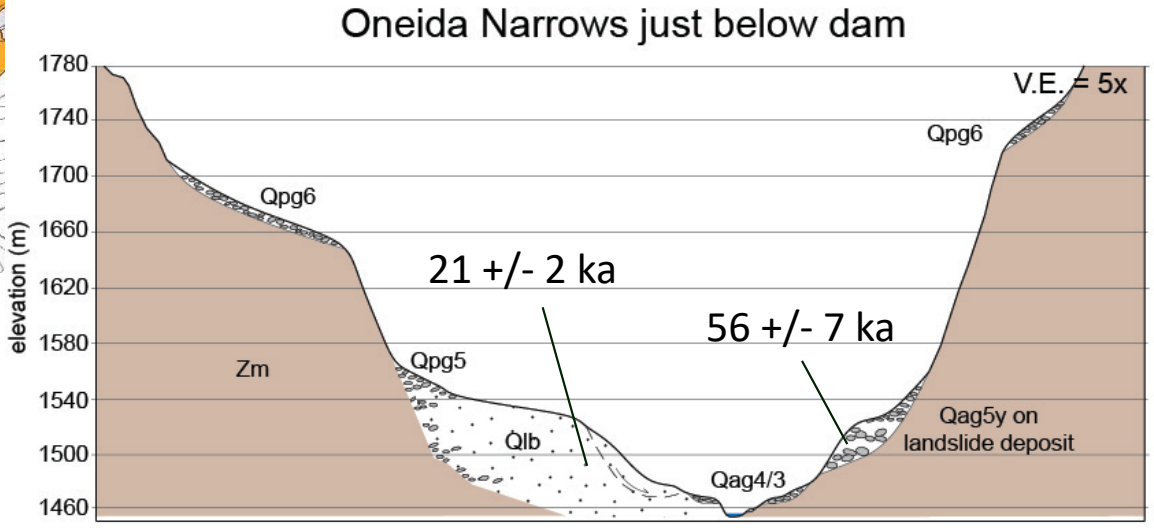

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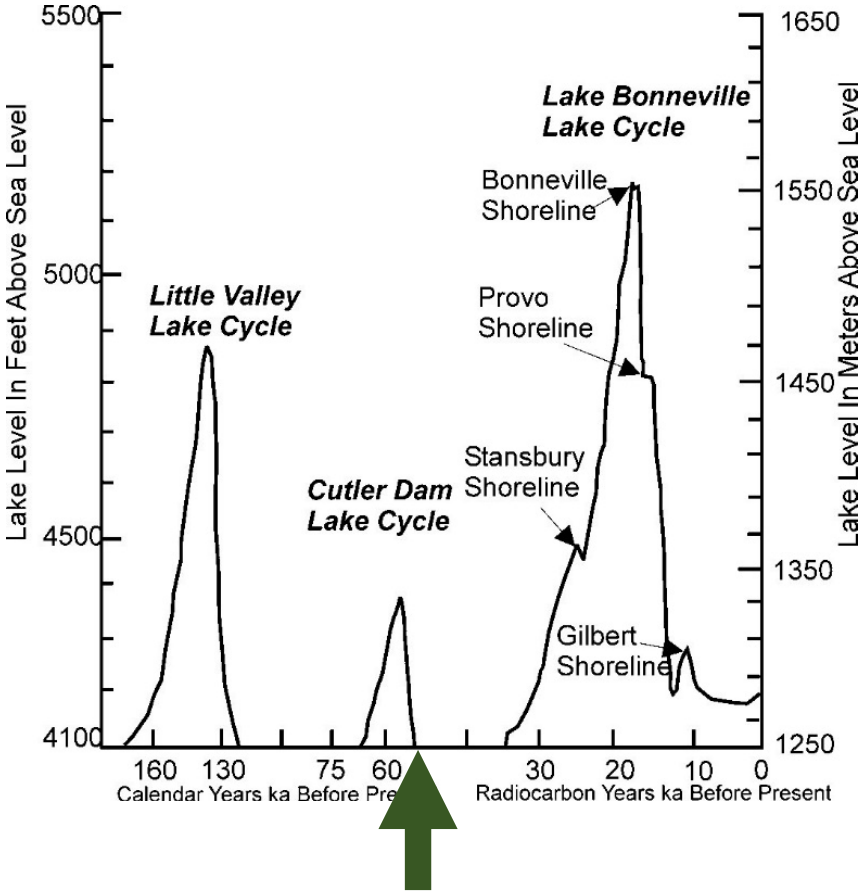

Bear River integration (MIS 3c)

Hart et al. (2004) *GSAB*

"…carbonates from the Little Valley and Cutler Dam lake cycles returned 87Sr/86Sr ratios of 0.71166 and 0.71207, respectively, and are too low to be produced by a lake without the upper Bear River input."

4. Relations to the Lake Bonneville record

Research needs

- Early Pleistocene path of upper Bear River

- Geology and geochronology of the (diverting) Gem Valley-Blackfoot volcanic field

- Main Canyon Fm. sedimentology

- Conflicting interpretation from Sr-isotope record – earlier incursion into Bonneville basin?