Environmental change and human adaptations in the Bonneville Basin, ca. 12,000-8,000 years ago

David Rhode
CEMP Annual Workshop
Ely, NV, July 2009

Community Environmental Monitoring Program

Acknowledgements

Colleagues

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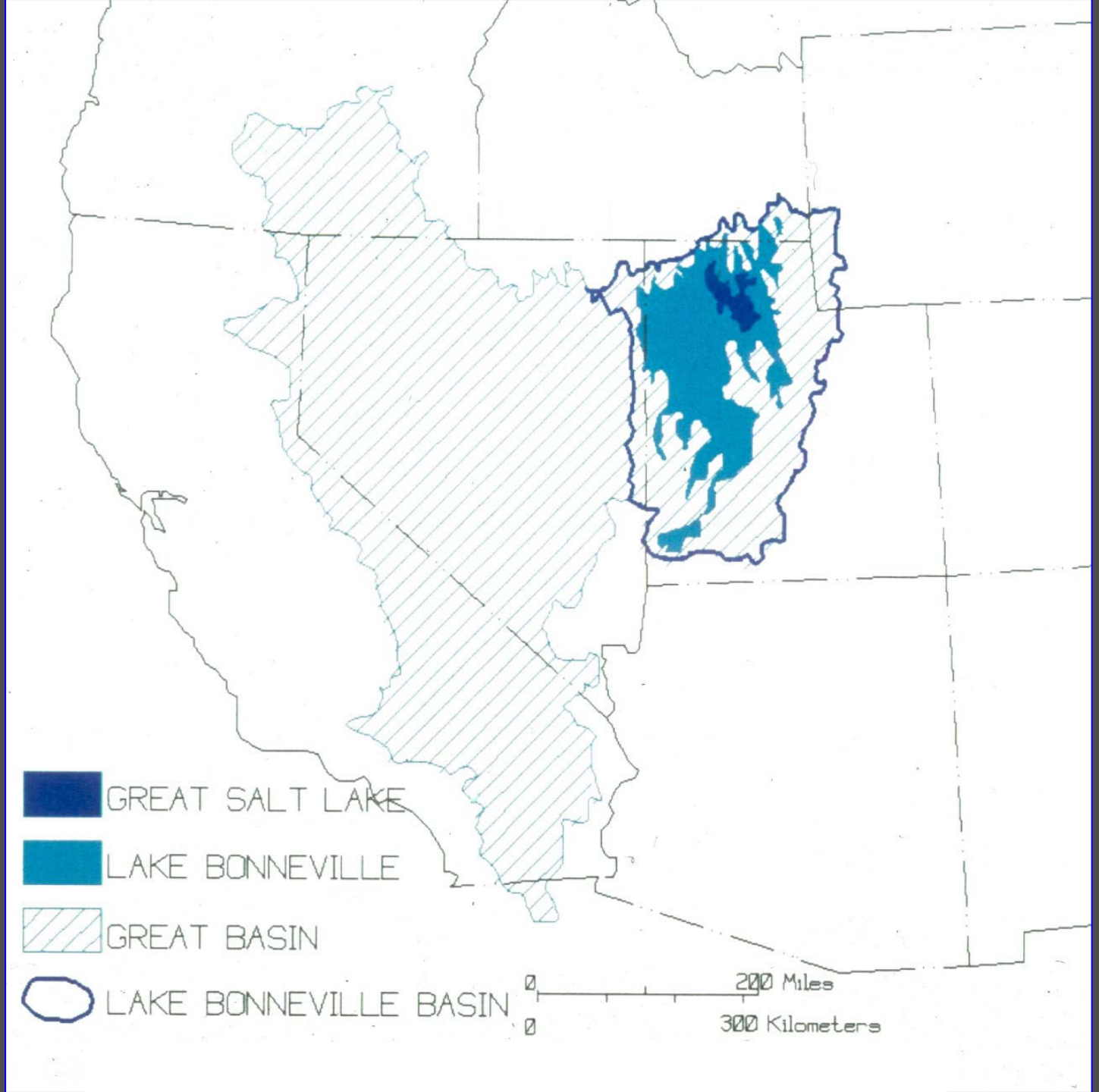
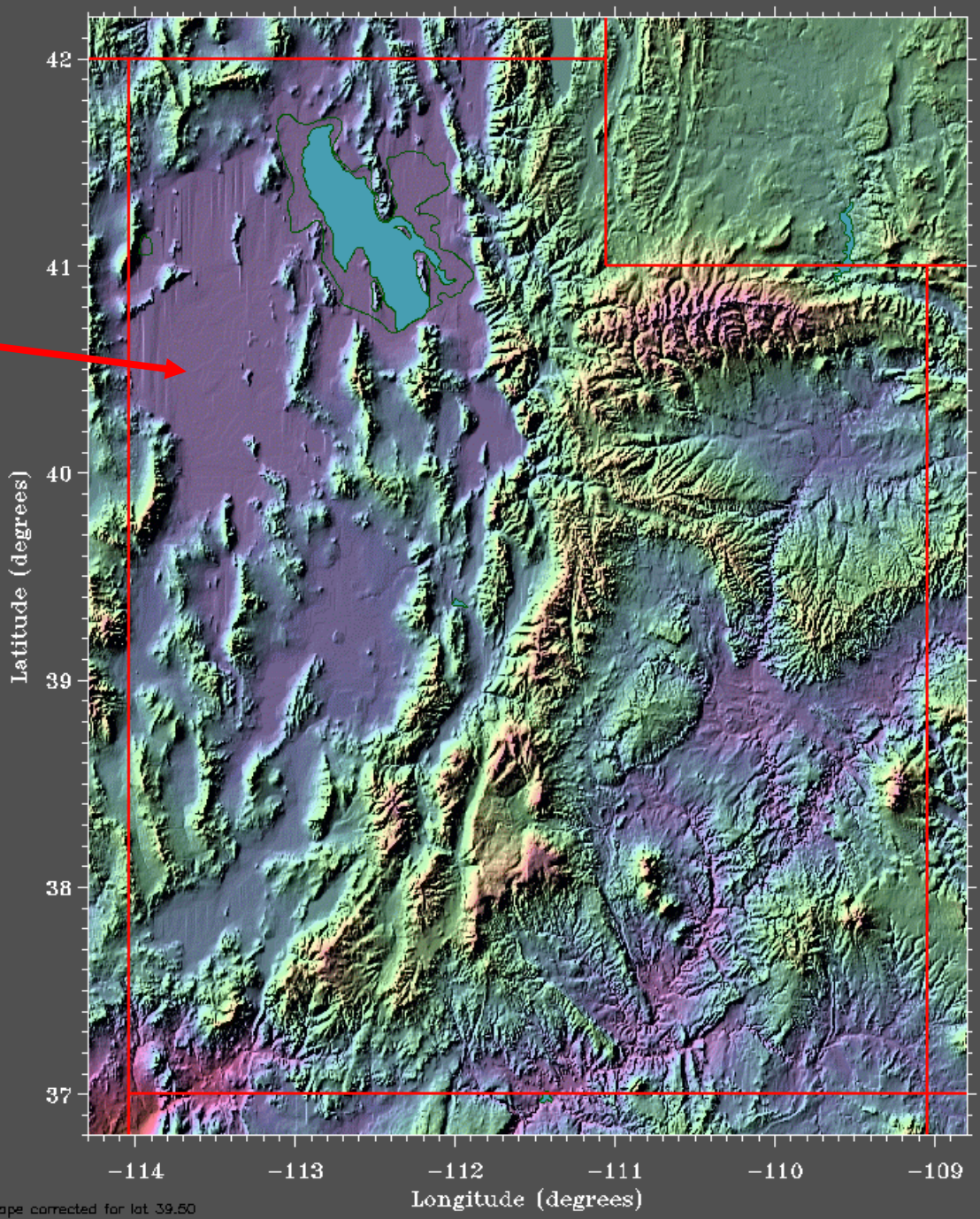
- Desert Research Institute – Lander Fund
- US Army – Dugway Proving Ground
- UNR – Sundance Endowment
- National Science Foundation
- US Geological Survey
- US Bureau of Land Management


GREAT SALT LAKE
LAKE BONNEVILLE
GREAT BASIN
LAKE BONNEVILLE BASIN
0
200 Miles
0
300 Kilometers

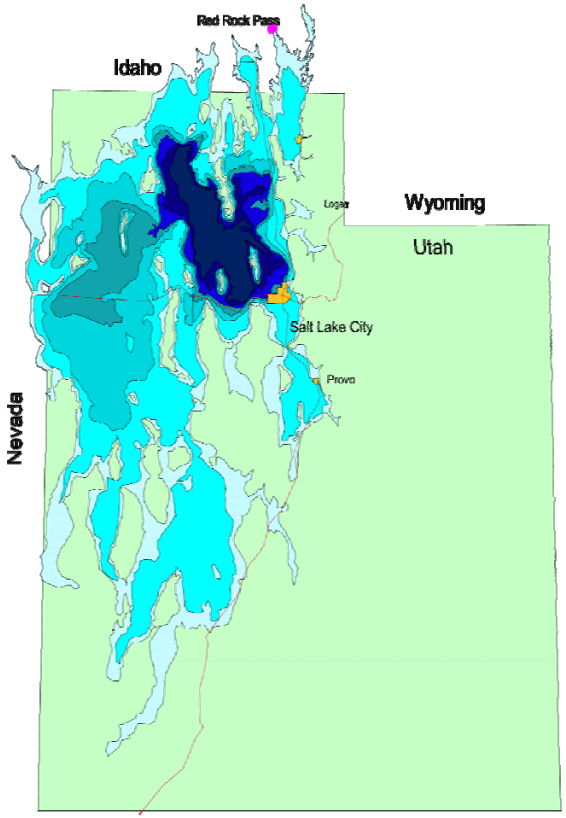
Outline

- Environmental change: the transition from glacial to interglacial climate and vegetation
- Early holocene human occupation: key archaeological sites
- Interactions between environmental change and human occupation

Bonneville Basin, western Utah



Shoreline Levels from Lake Bonneville to Present Great Salt Lake



source: Currey, Donald. et al. 1983. Major Levels of Great Salt Lake and Lake Bonneville. Utah Geological Survey. Map 73

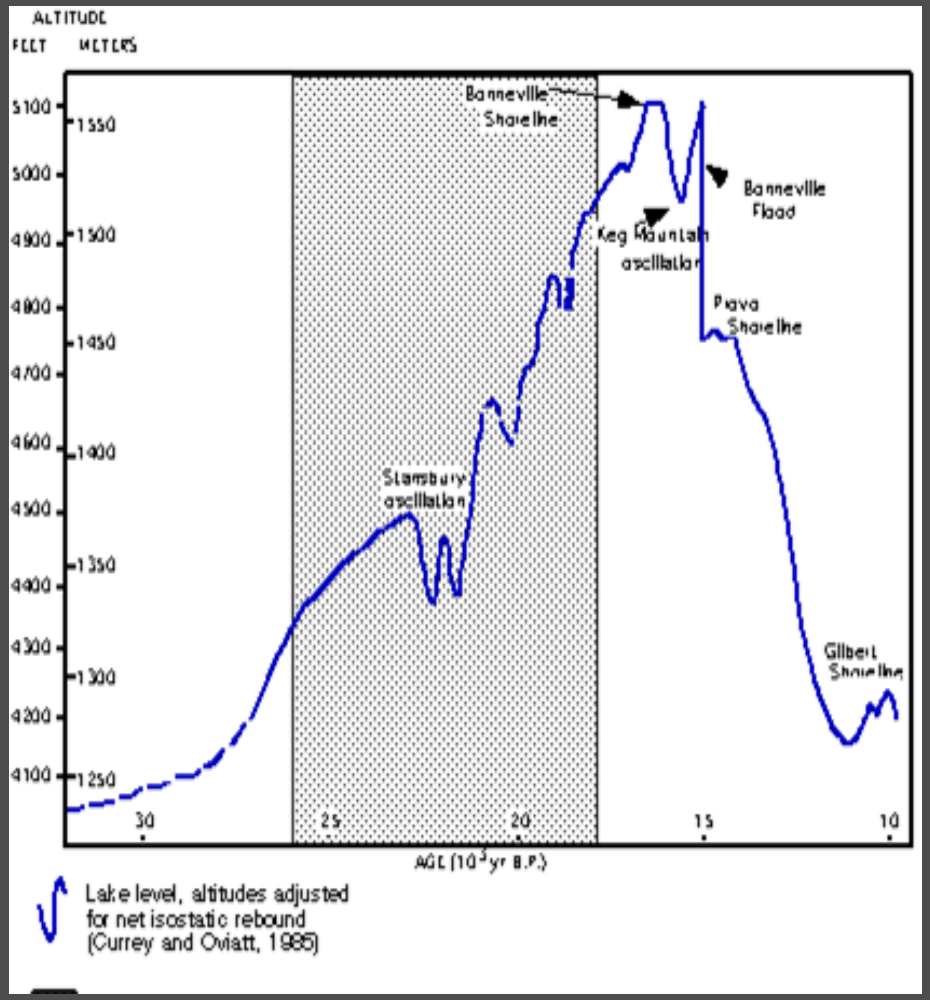
Legend

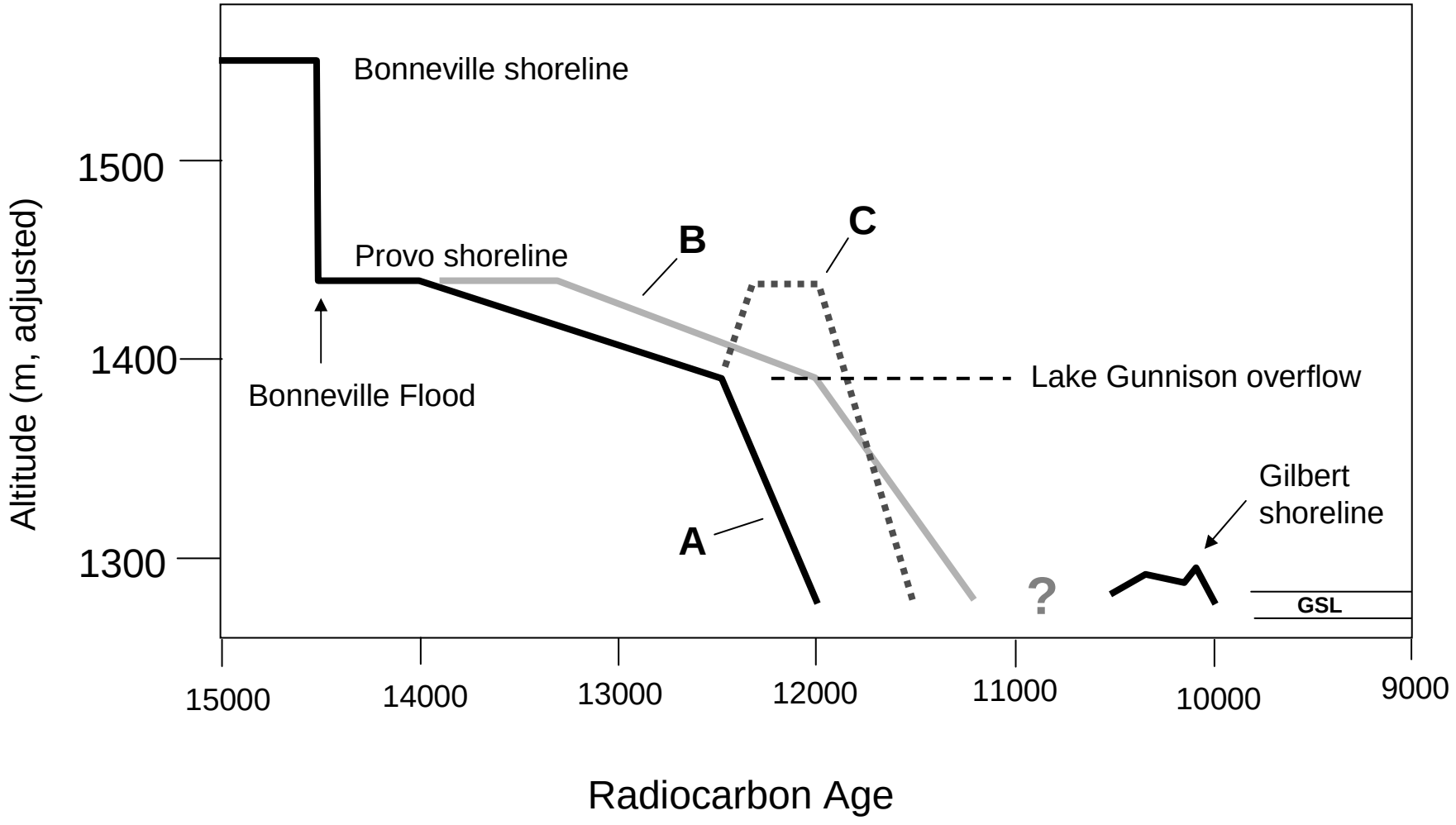
Lake Levels
- Historic Low (1963)
- Great Salt Lake
- Historic High (1987)
- Prehistoric High (~1600 A.D.)
- Altithermal (6, 700-6,000 B.P.-- dessication)
- Gilbert Level (11,000-10,000 B.P.)
- Provo Level (14,500-13,500 B.P.)
- Bonneville Level (16,000-14,500 B.P.)

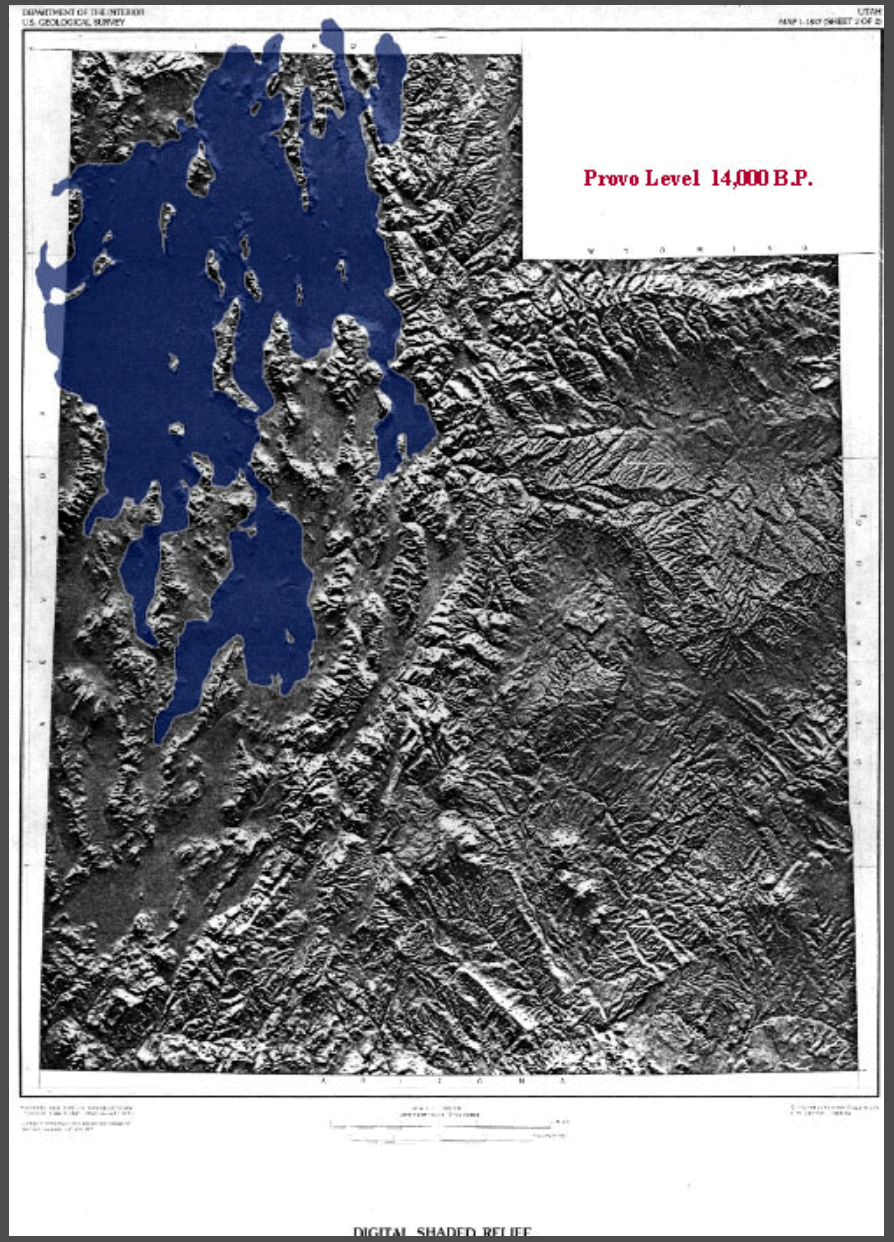
- Red Rock Pass
- Interstate Highway
- Urban Area

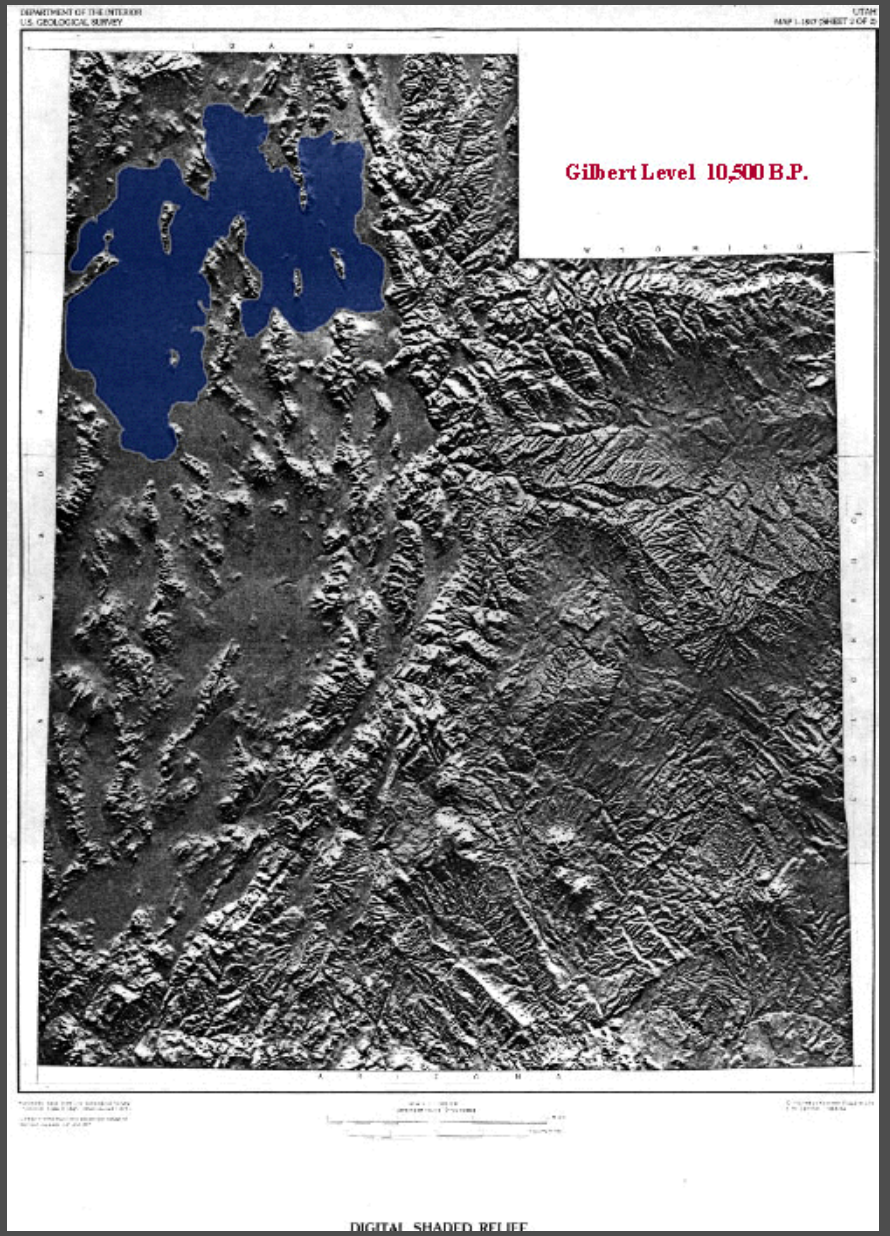
N W E S

by Brian Maeblus

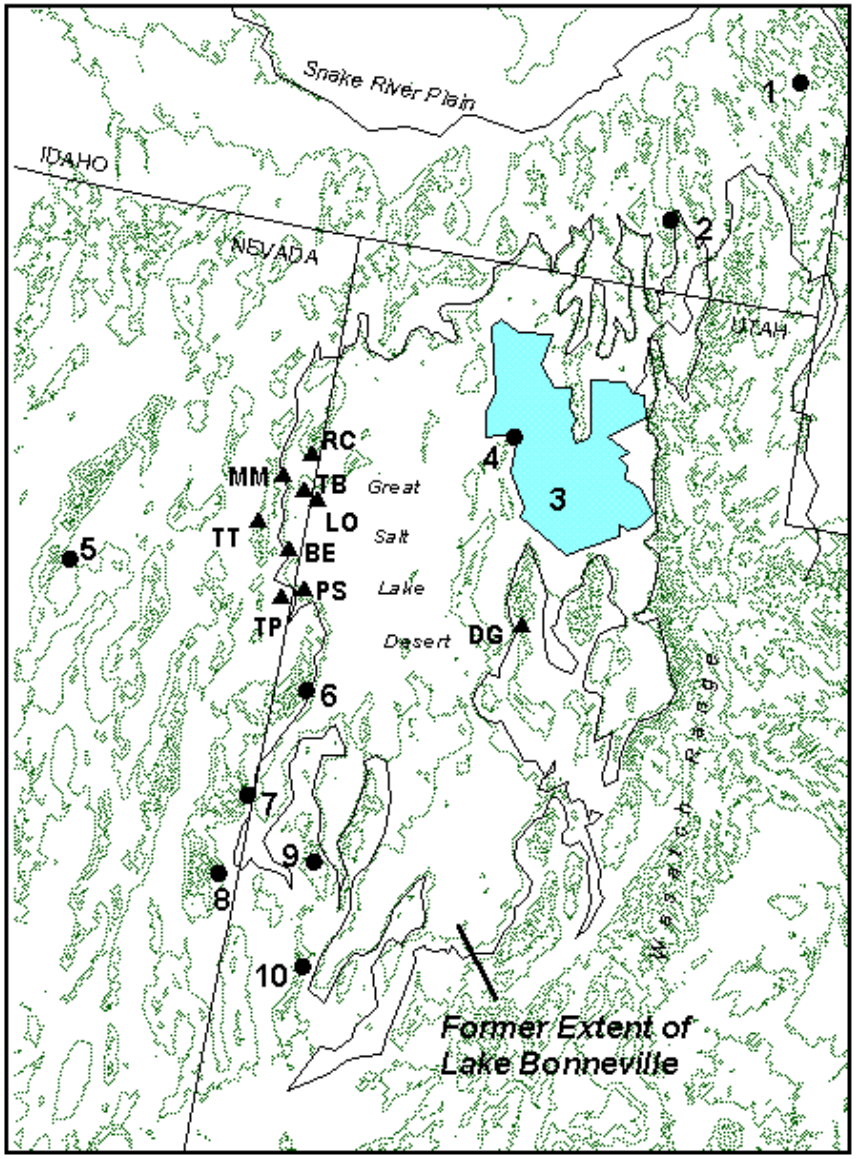



Bonneville shoreline
Provo shoreline
B
C
Bonneville Flood
Lake Gunnison overflow
A
?
Gilbert
shoreline
GSL
1500
1400
1300
Altitude (m, adjusted)
15000
14000
13000
12000
11000
10000
9000
Radiocarbon Age


Provo Level 14,000 B.P.

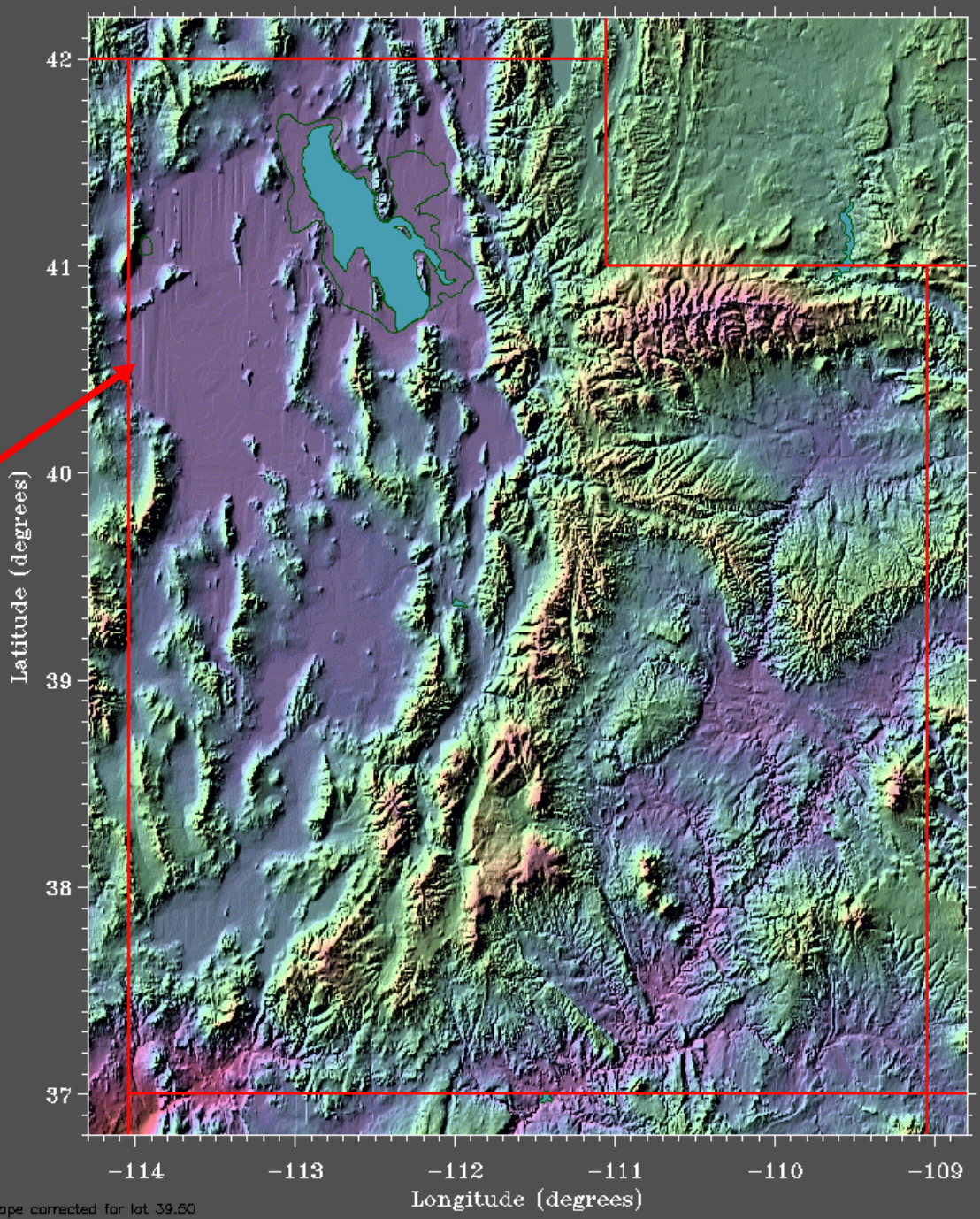

Gilbert Level 10,500 B.P.

Paleovegetation records: Packrat middens and pollen cores

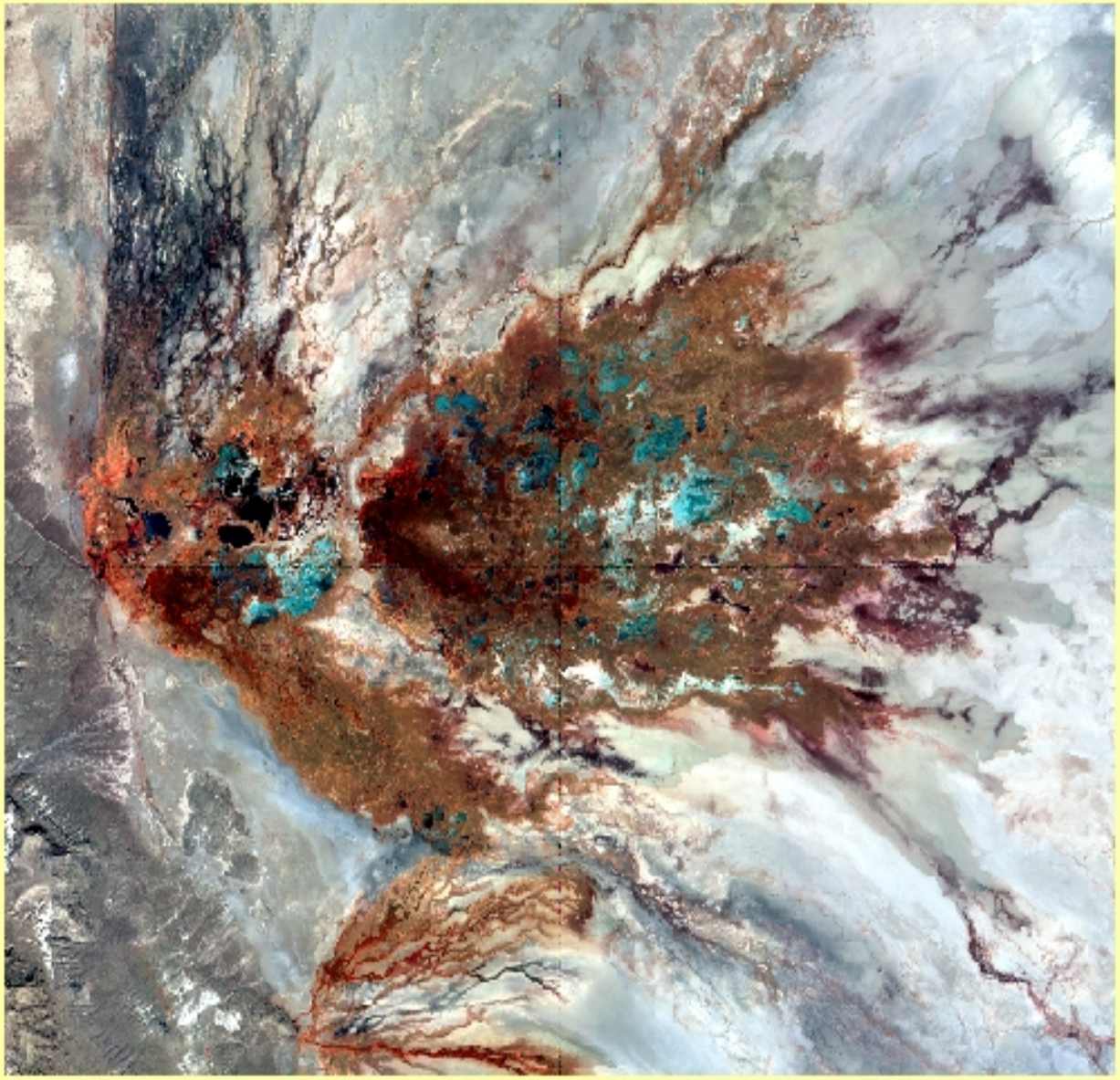



Bushy-tailed Woodrat
(Neotoma cinerea)
PACKRAT MIDDENS

Paleovegetation records: Pollen cores



Blue Lake Utah - 2,3,4 Standard False Color

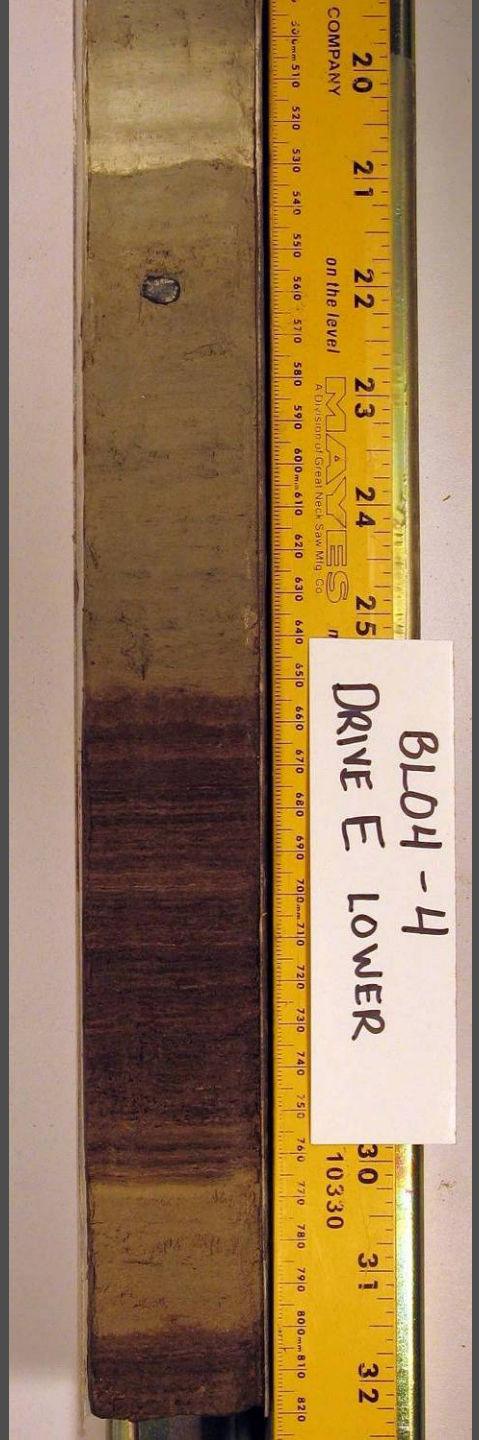


Meters
1000.00

IKONOS 19 Oct 2000

True North


Blue Lake, western Utah



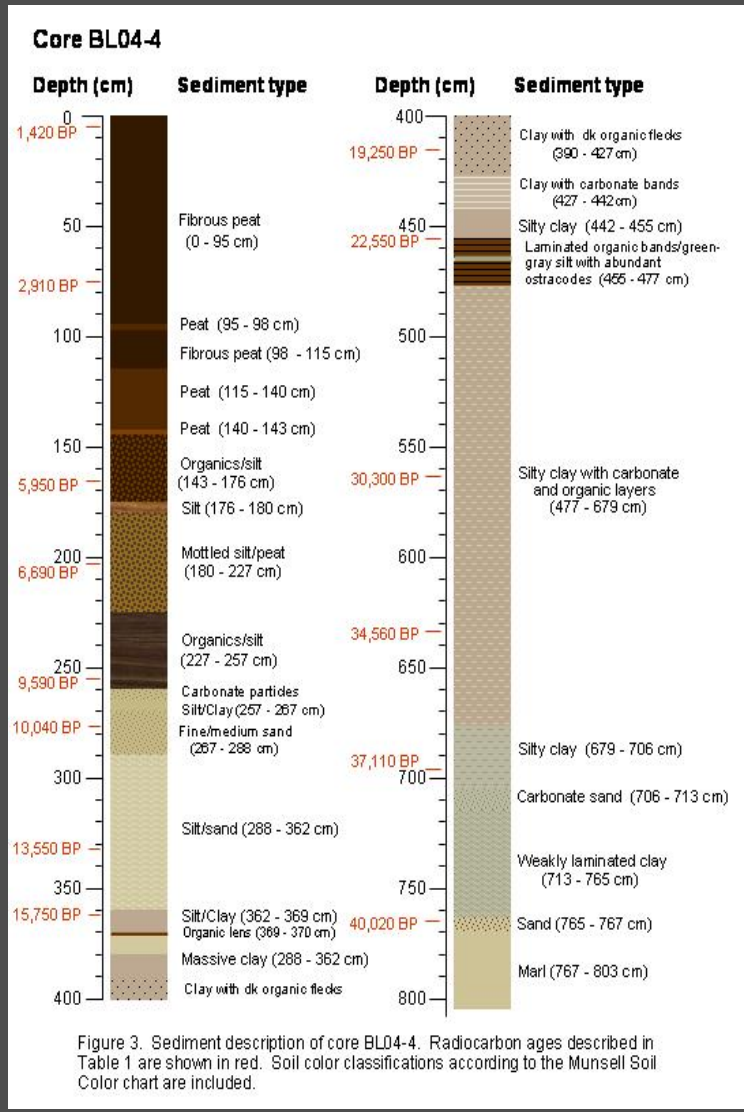
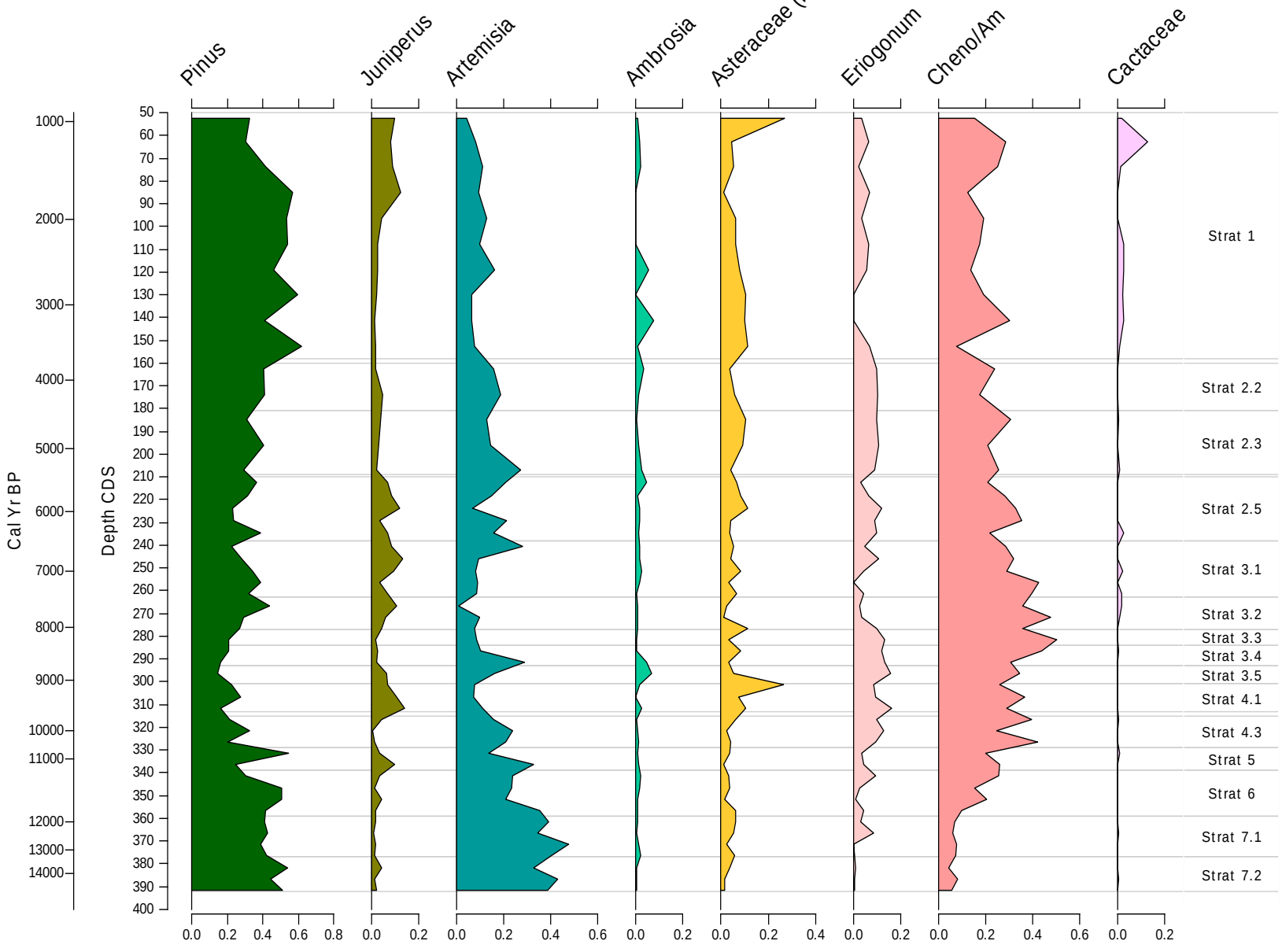


Figure 3. Sediment description of core BL04-4. Radiocarbon ages described in Table 1 are shown in red. Soil color classifications according to the Munsell Soil Color chart are included.

Pollen

Holocene Vegetation Changes
Blue Lake, western Utah



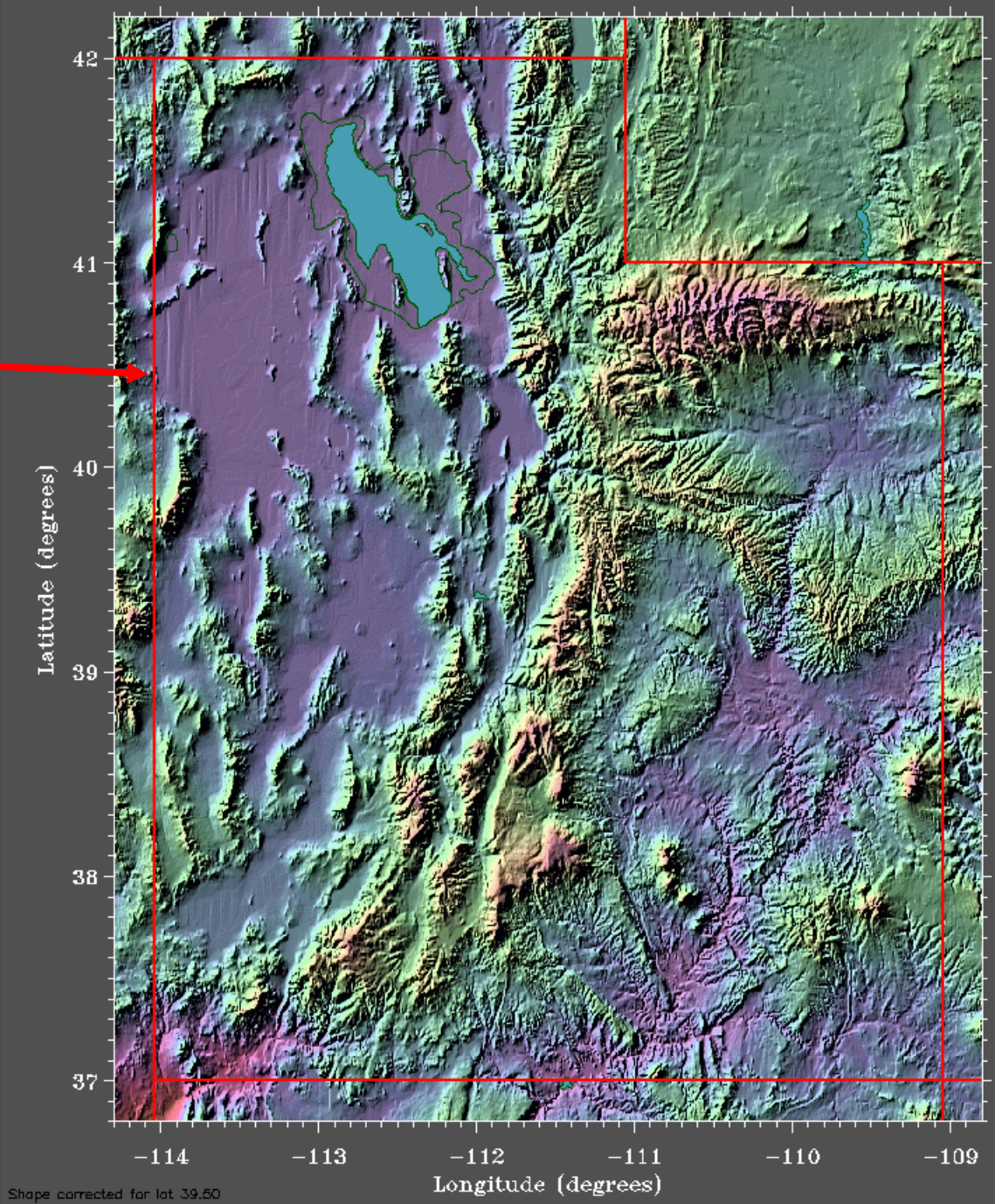
Summary of early Holocene environmental change

- Prior to ~12,000 years ago: Lake Bonneville at Provo level, vegetation largely subalpine conifer-sagebrush mosaic
- ~12,000-10,500 years ago: lake declines to low levels, vegetation becomes more xeric but still dominated by conifers and sagebrush
- 10,500-10,000 years ago: lake expands to Gilbert level, subalpine conifers and sagebrush decline and desert shrubs expand
- 10,000-8600 years ago: lake declines, marshes expand on playa floor, valley vegetation dominated by xeric desert shrubs, sparse pine-juniper woodlands in uplands
- After 8600 years ago: marshes dry up, desert shrubs dominate in open landscape, upland juniper woodlands further reduced.

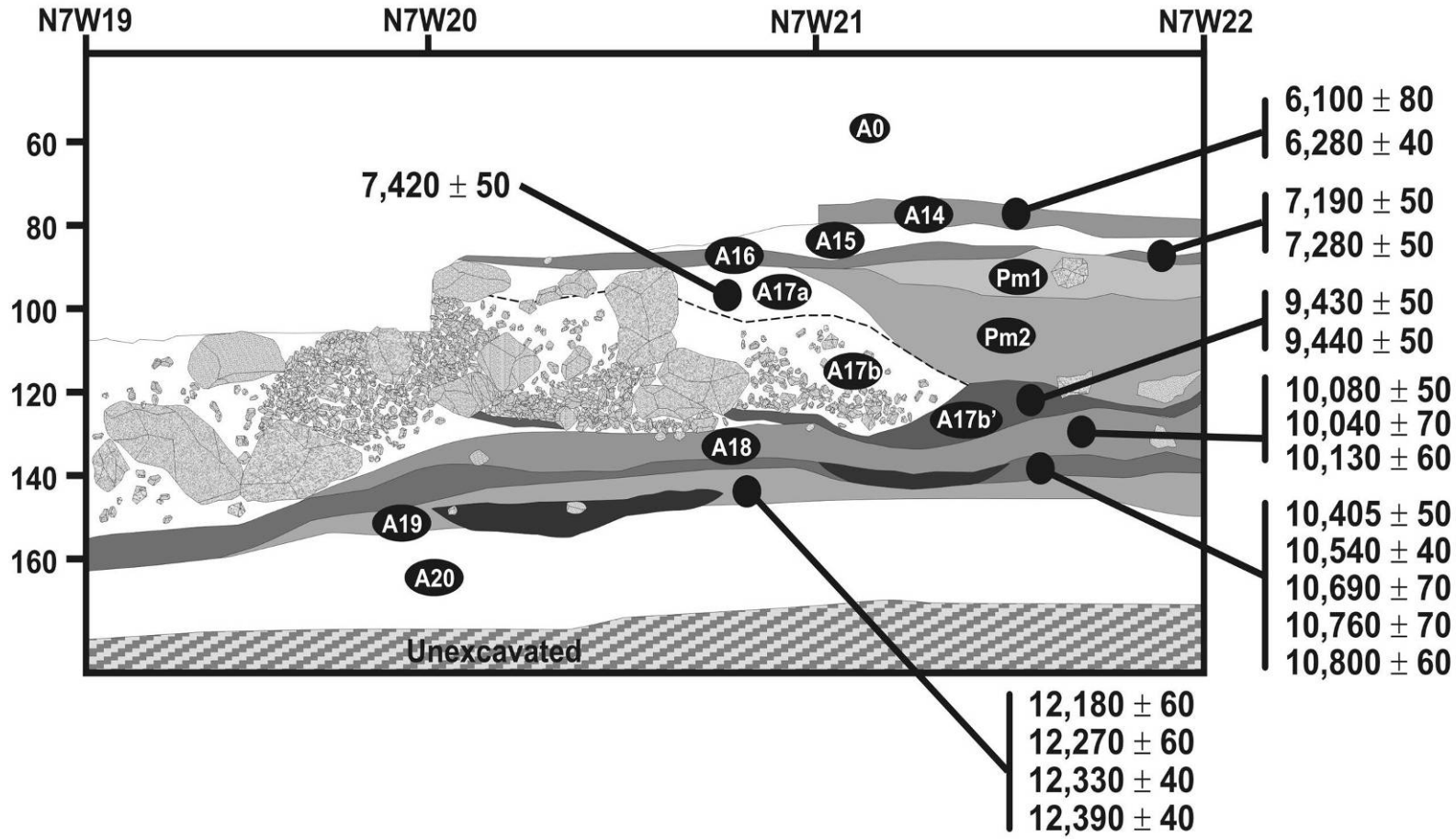
Early Holocene human occupation: key archaeological sites

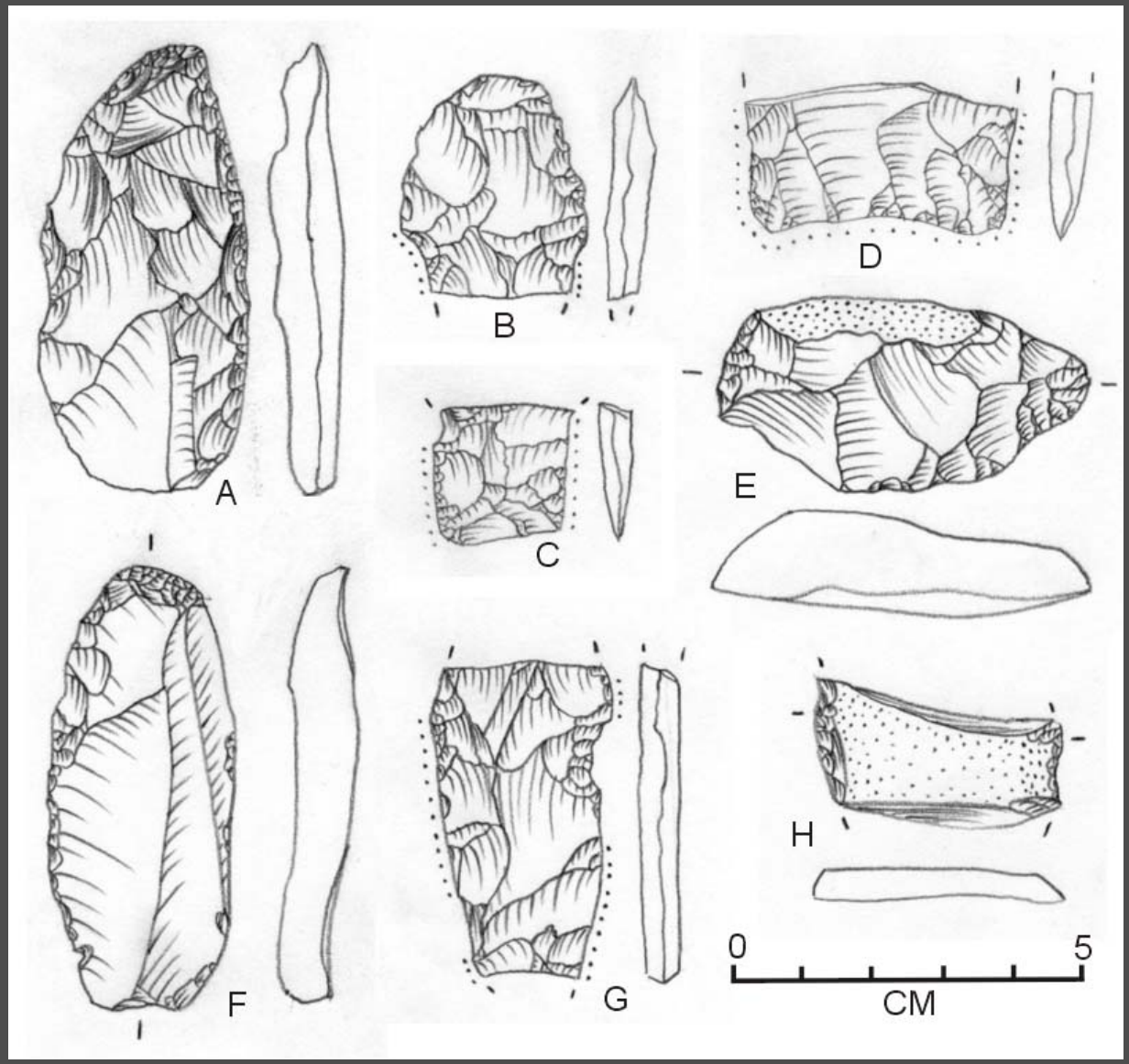
- Bonneville Estates Rockshelter
- Old River Bed site complex
- Danger Cave

Bonneville Estates Rockshelter



Bonneville Estates Rockshelter
Late Pleistocene-Early Holocene Profile




A
B
C
D
E
F
G
H
0
5
CM

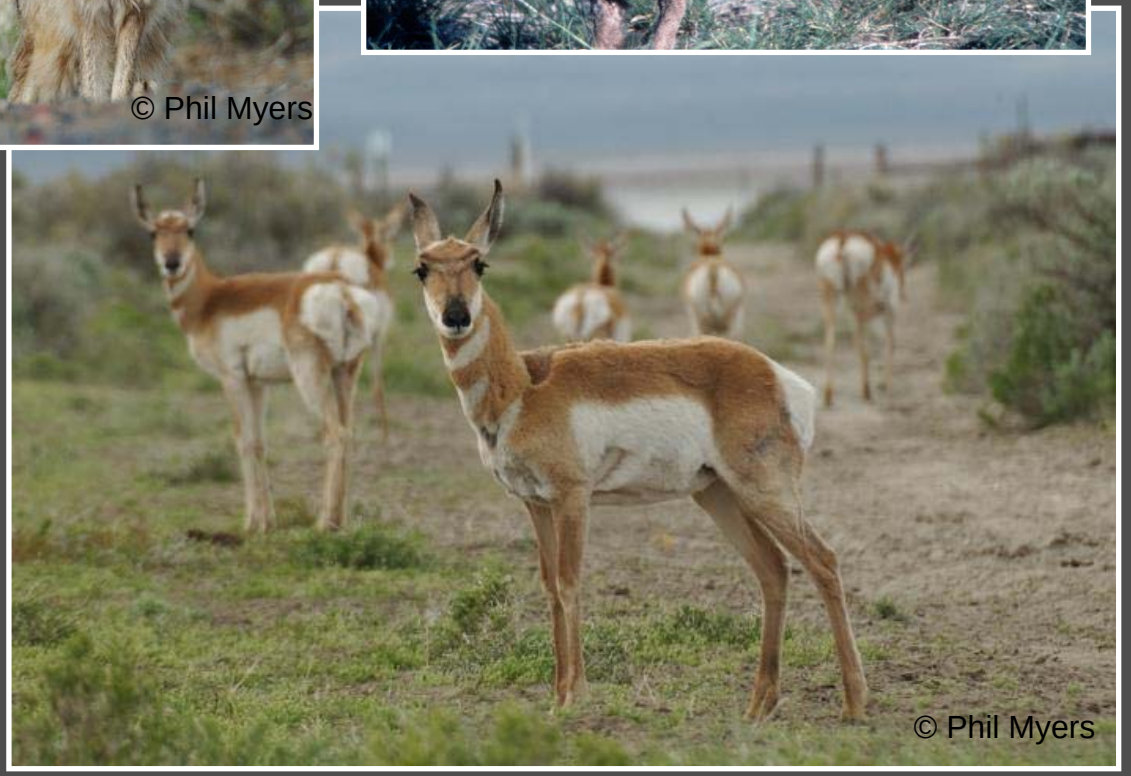
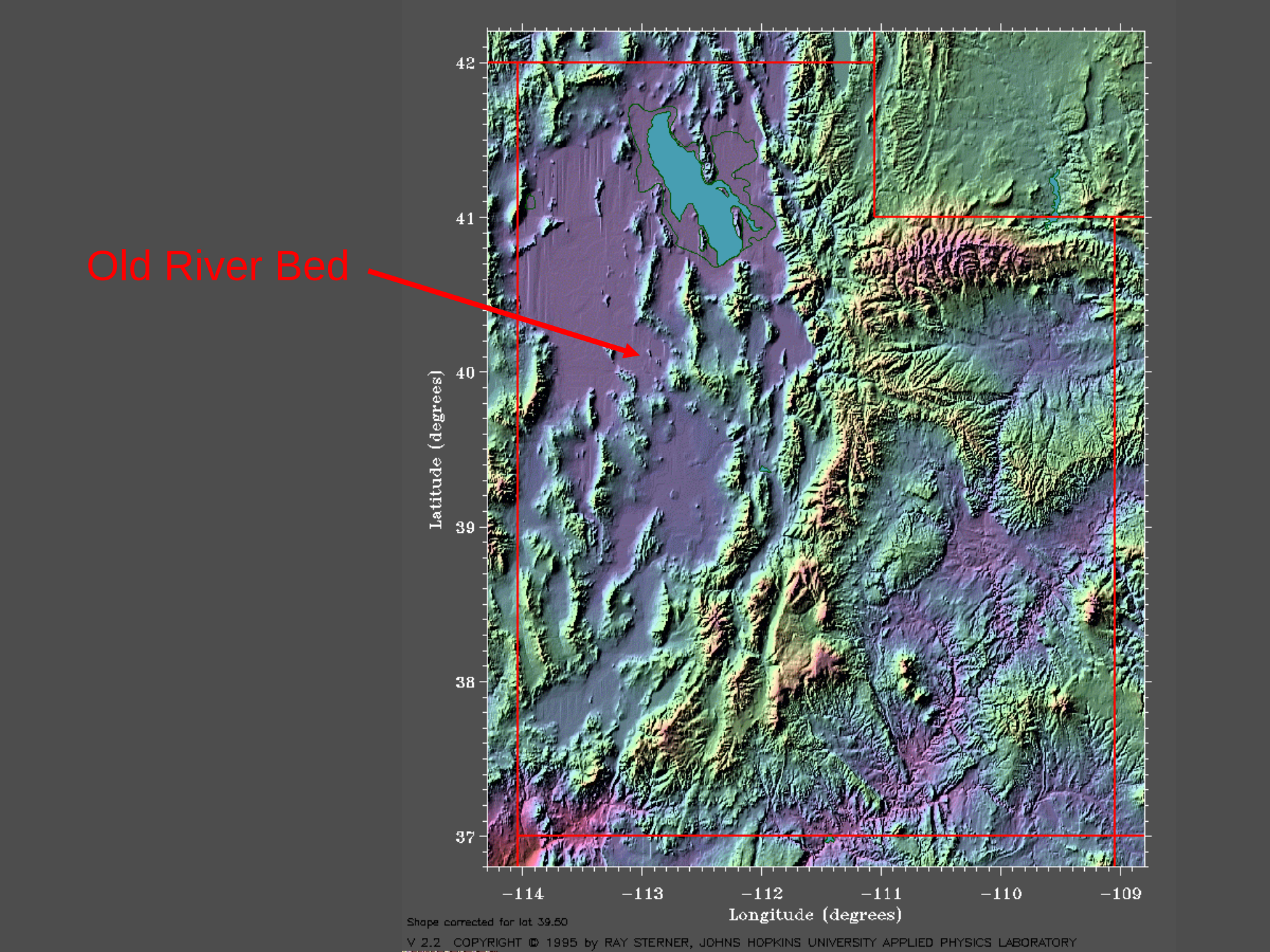


Photo credits: Myers, P., R. Espinosa, C. S. Parr, T. Jones, G. S. Hammond, and T. A. Dewey. 2005. The Animal Diversity Web (online). Accessed October 09, 2005 at http://animaldiversity.org.


Old River Bed
42
41
40
39
38
37
Latitude (degrees)
−114
−113
−112
−111
−110
−109
Longitude (degrees)
Shape corrected for lat 39.50
V 2.2 COPYRIGHT © 1995 by RAY STERNER, JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY

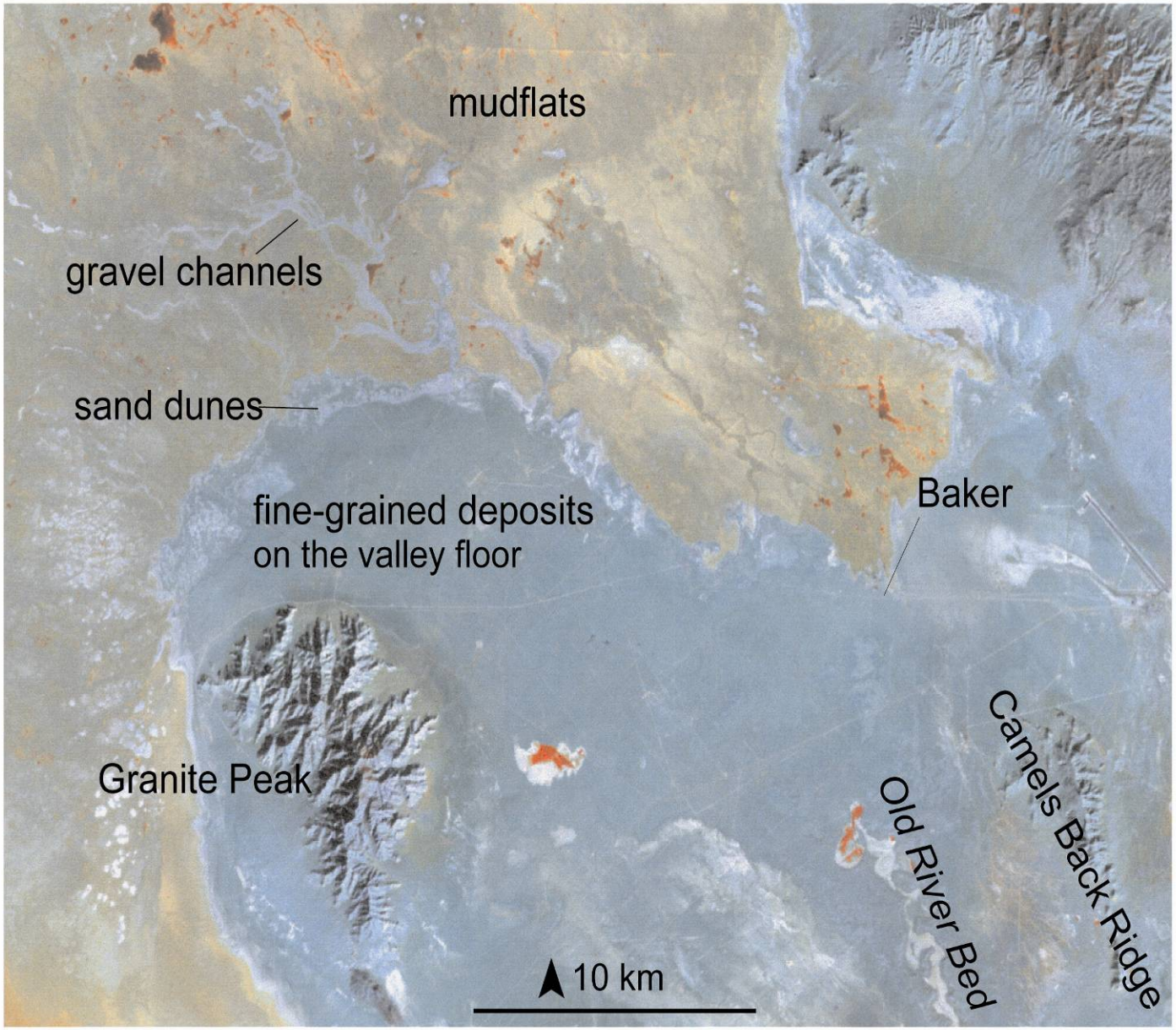
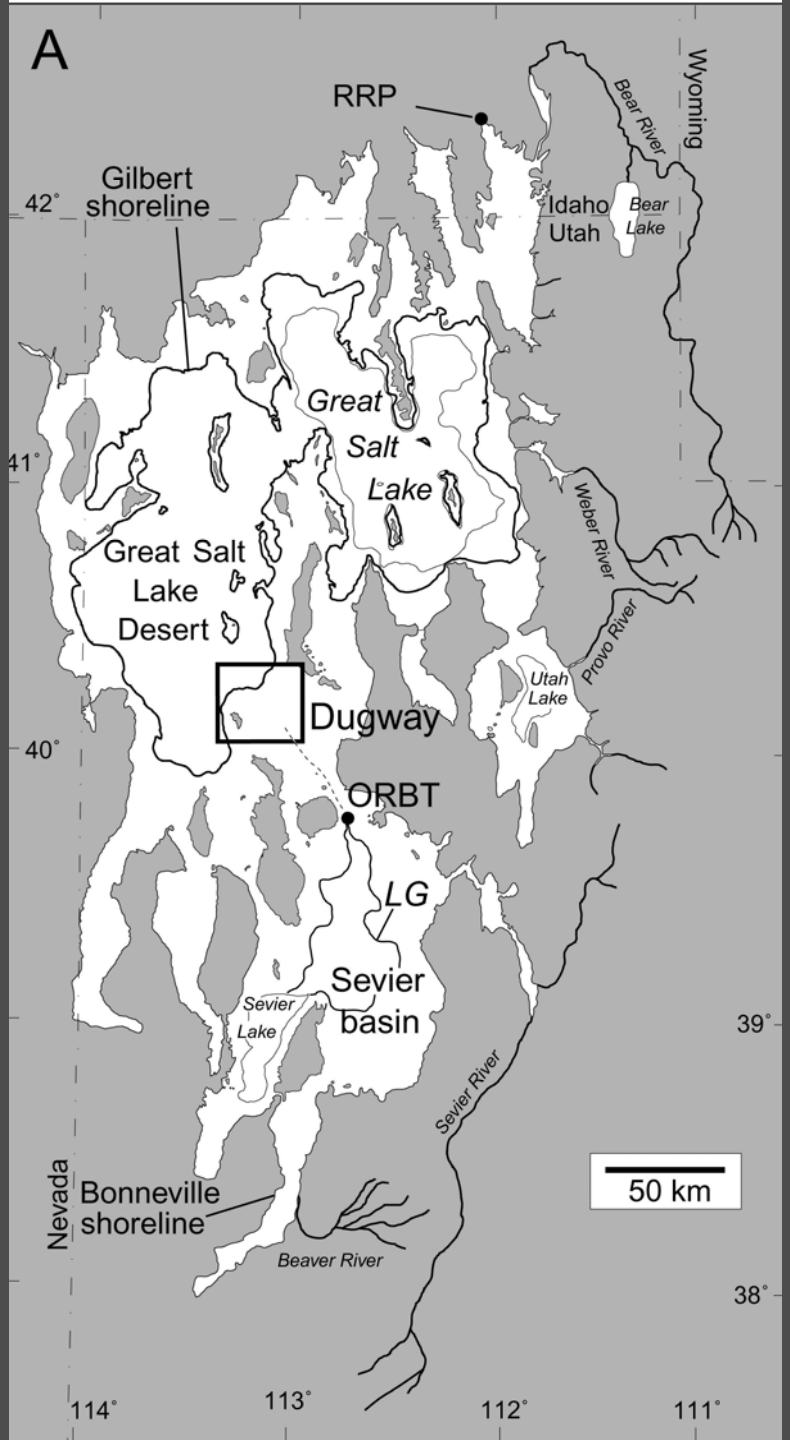
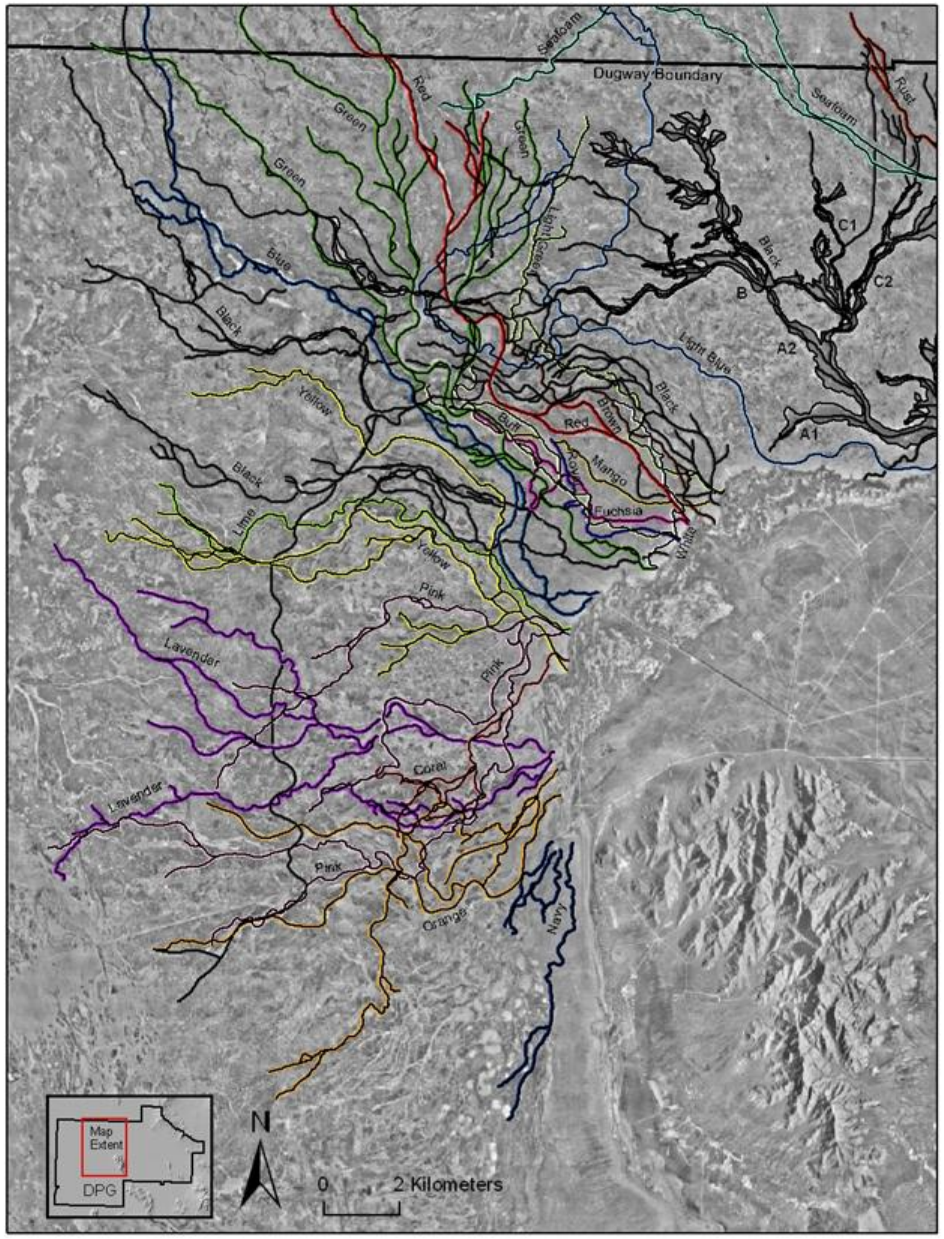


Figure 2. Enhanced satellite image showing primary geomorphic features in the Old River Bed delta.


A
RRP
Gilbert
shoreline
Wyoming
Bear River
Idaho
Utah
Bear
Lake
42˚
Great
Salt
Lake
41˚
Weber River
Great Salt
Lake
Desert
Provo River
Utah
Lake
Dugway
40˚
ORBT
LG
Sevier
basin
Sevier
Lake
39˚
Sevier River
50 km
Nevada
Bonneville
shoreline
Beaver River
38˚
114˚
113˚
112˚
111˚


Silver Island Mountains
Danger Cave
Great Salt Lake
Goshute Mountains
80
UTTR
Blue Lake
Bonneville Estates Rockshelter
93
GREAT
SALT
LAKE
DESERT
Wildcat Mnt
DPG
Cedar Mountain Range
Stansbury Mountains
Onaqui Mountains
138
112
199
36
NEVADA
UTAH
ORB Delta
Granite Peak
Camels Back Cave
Antelope Range
Deep Creek Range
Dugway Range
Old Pluvial Bed
Simpson Mountains
Sheeprock Mountains
Fish Springs Range
Fish Springs
Thomas Range
Keg Mountain
OR
ID
WY
NV
UT
CA
AZ
N
0
5 Miles
0
10 Kilometers


Dugway Boundary
Seafoam
Rust
Red
Green
Light Green
Blue
Black
Yellow
Lime
Burgundy
Mango
Fuchsia
White
Pink
Lavender
Coral
Orange
Navy
Brown
Light Blue
C1
C2
B
A2
A1
Map Extent
DPG
N
0
2 Kilometers

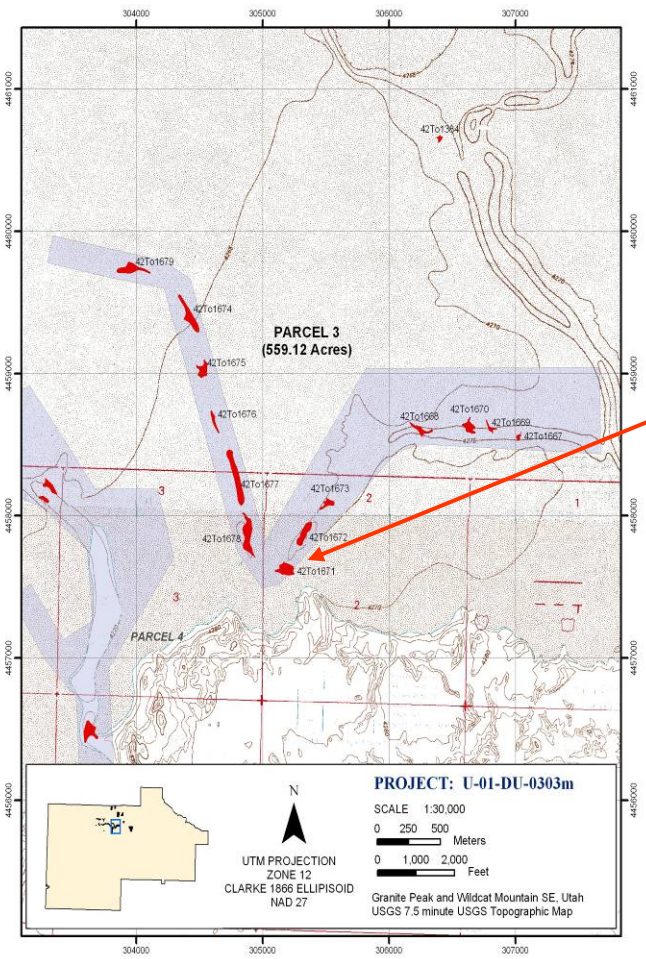
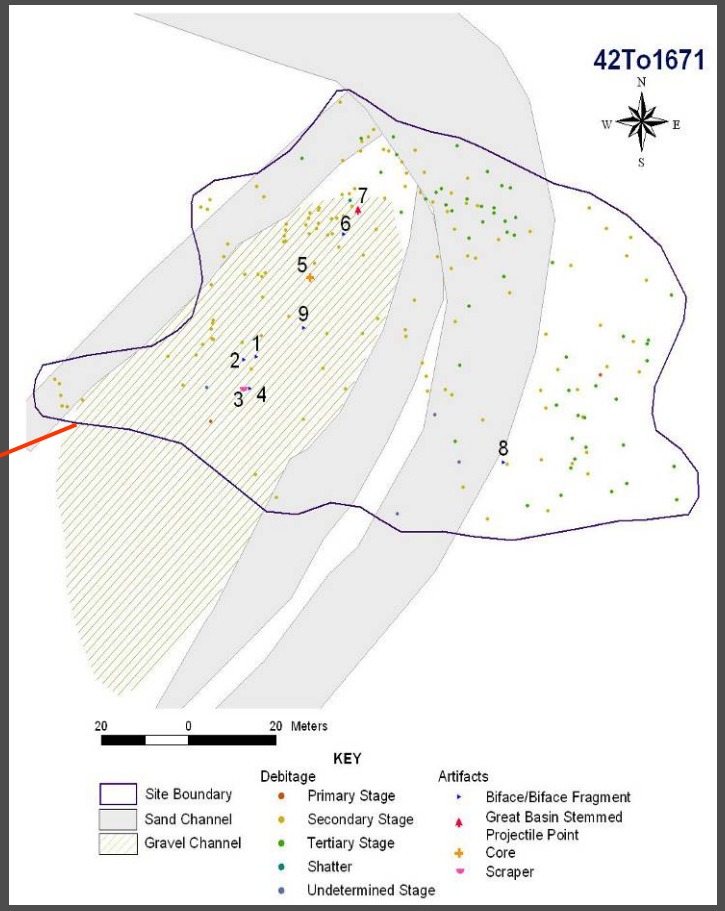
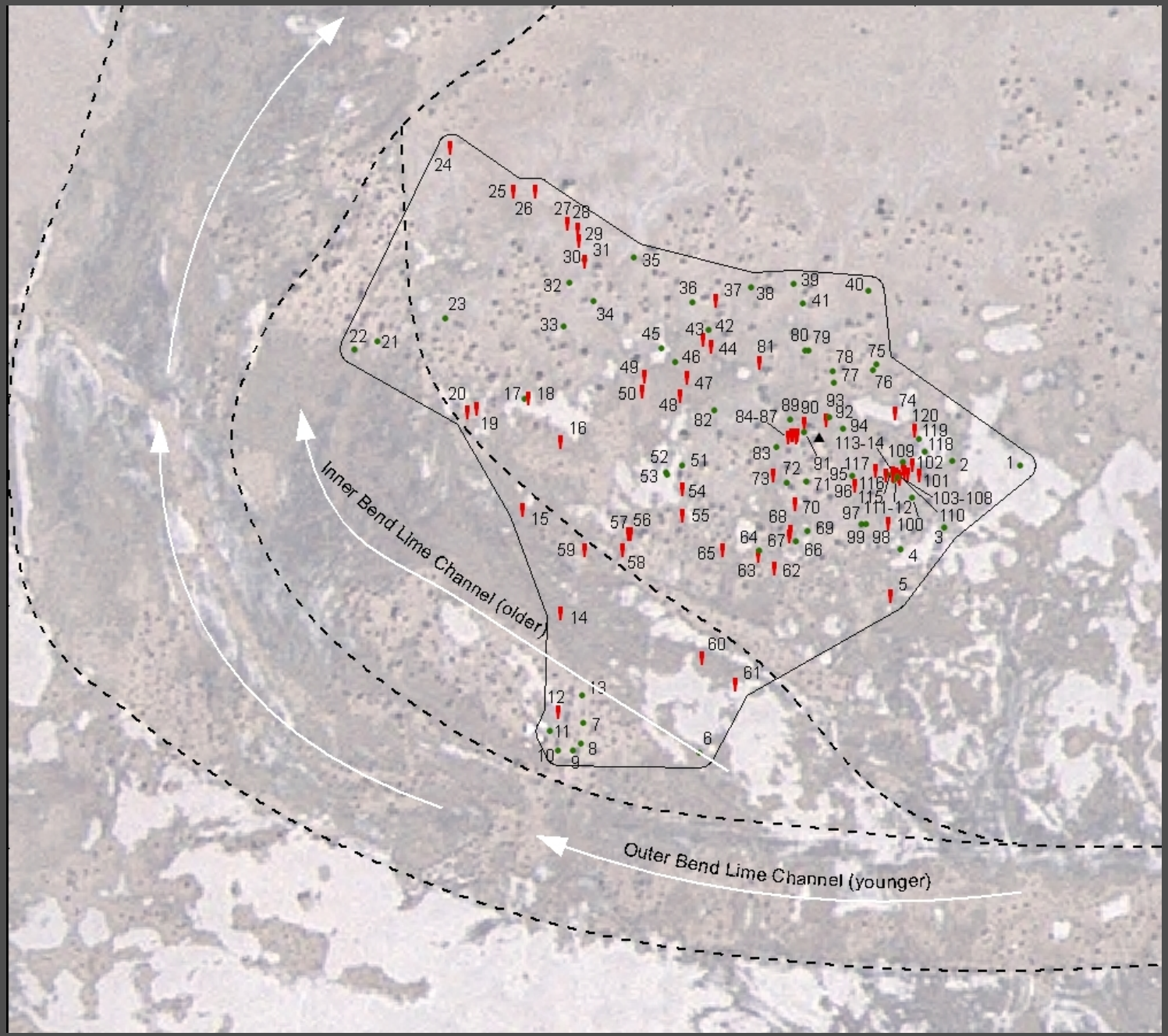


Figure 6. Location of survey Parcel 3 and recorded sites.



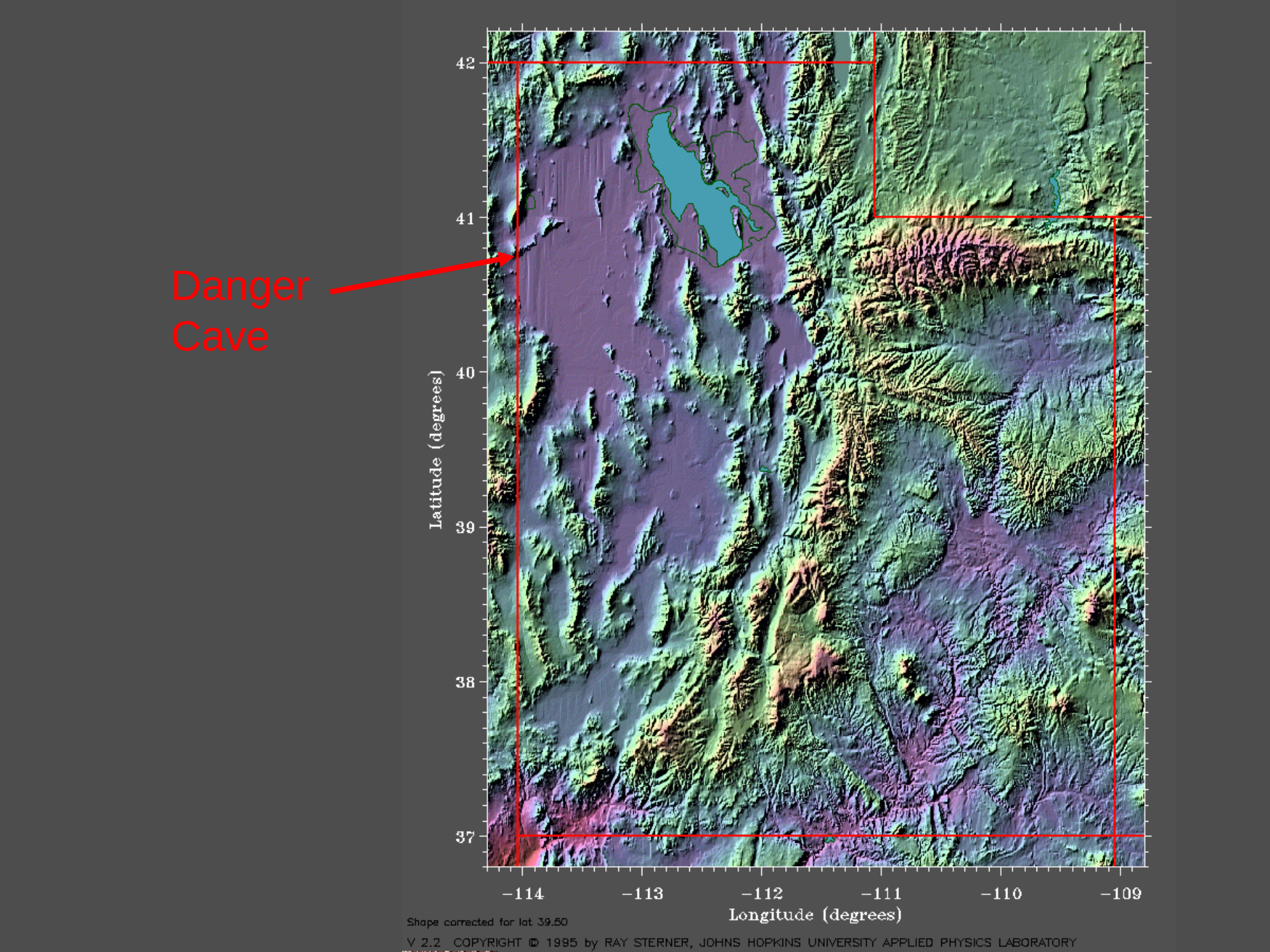
Old River Bed Delta Channel
Site 42To1671


Inner Bend Lime Channel (older)
Outer Bend Lime Channel (younger)


cm


CM


CM


Danger
Cave
42
41
40
39
38
37
Latitude (degrees)
−114
−113
−112
−111
−110
−109
Longitude (degrees)
Shape corrected for lat 39.50
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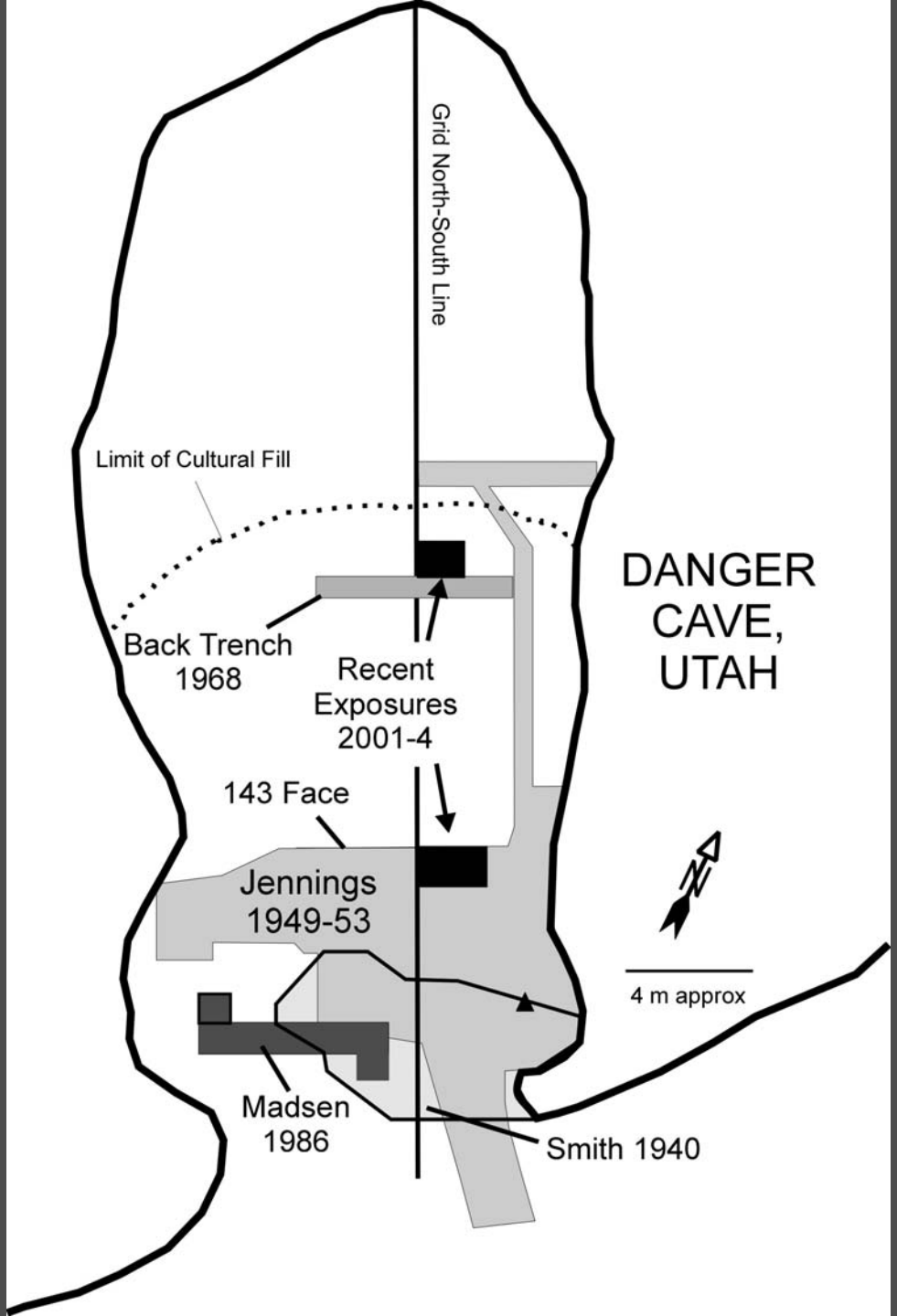
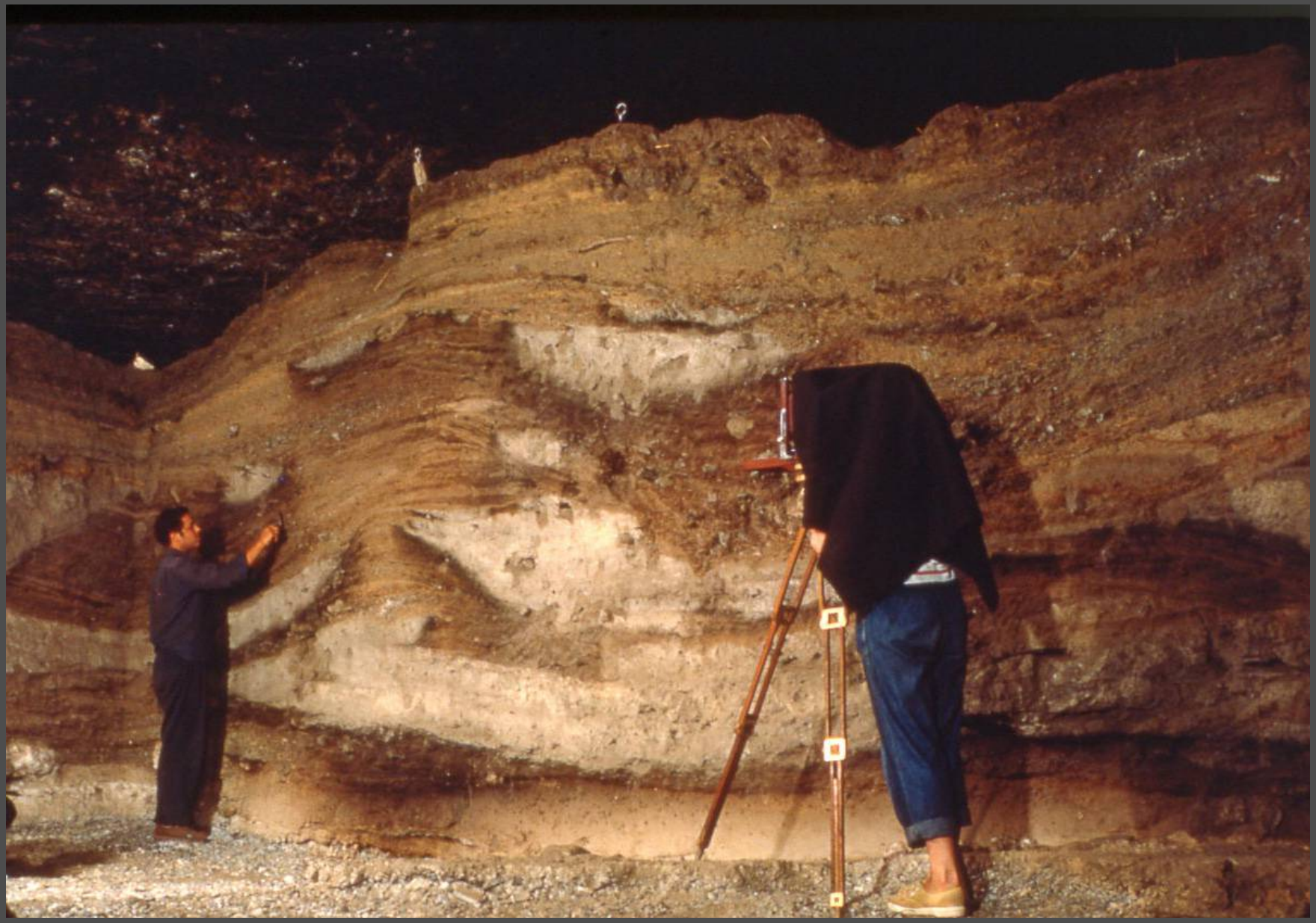
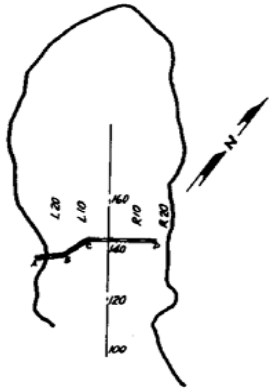
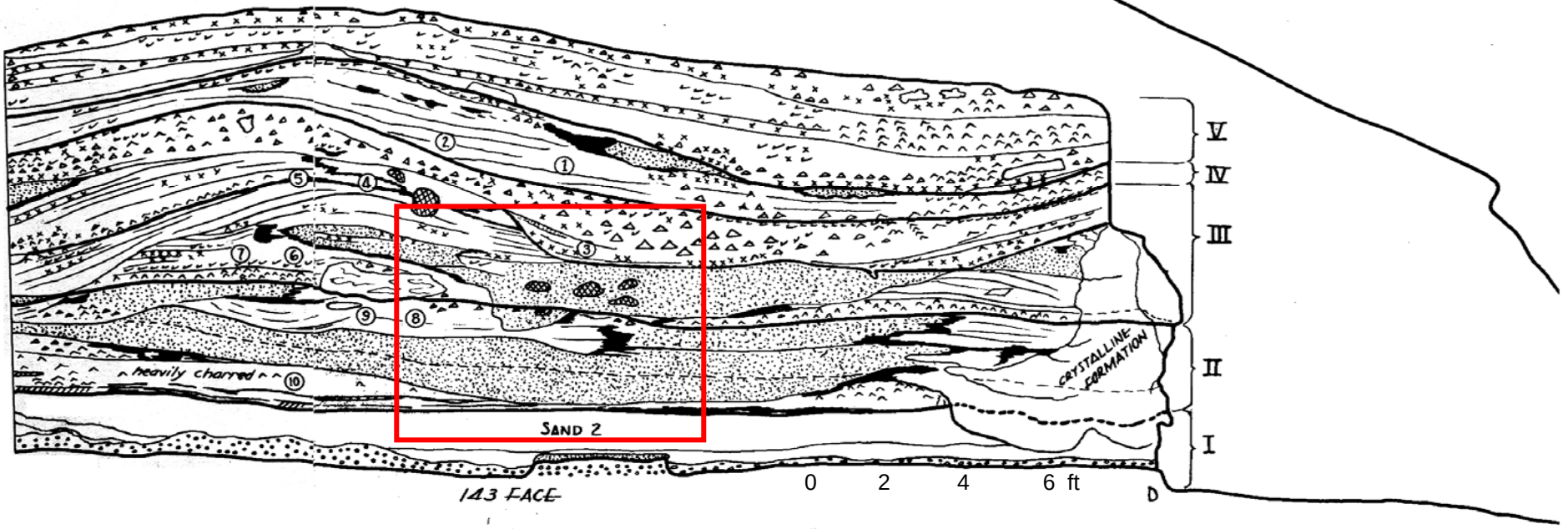

Grid North-South Line
Limit of Cultural Fill
DANGER CAVE, UTAH
Back Trench 1968
Recent Exposures 2001-4
143 Face
Jennings 1949-53
4 m approx
Madsen 1986
Smith 1940



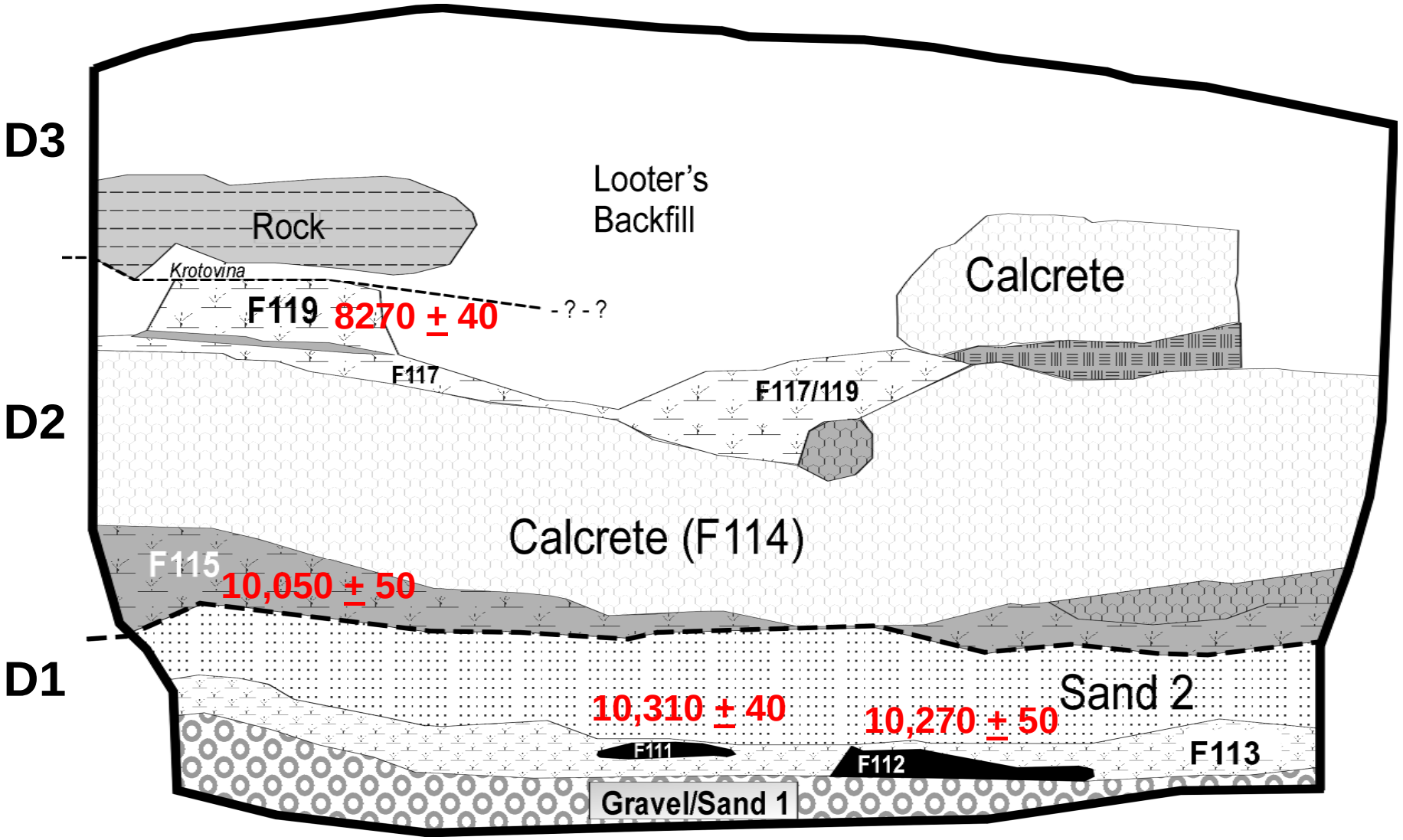
Danger Cave 143 Face Stratigraphy (Jennings 1957)

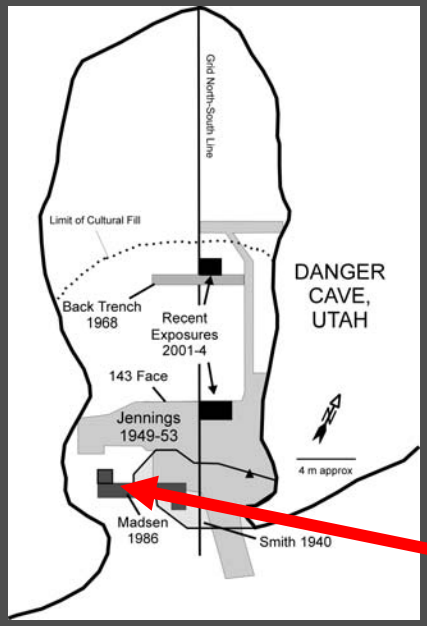


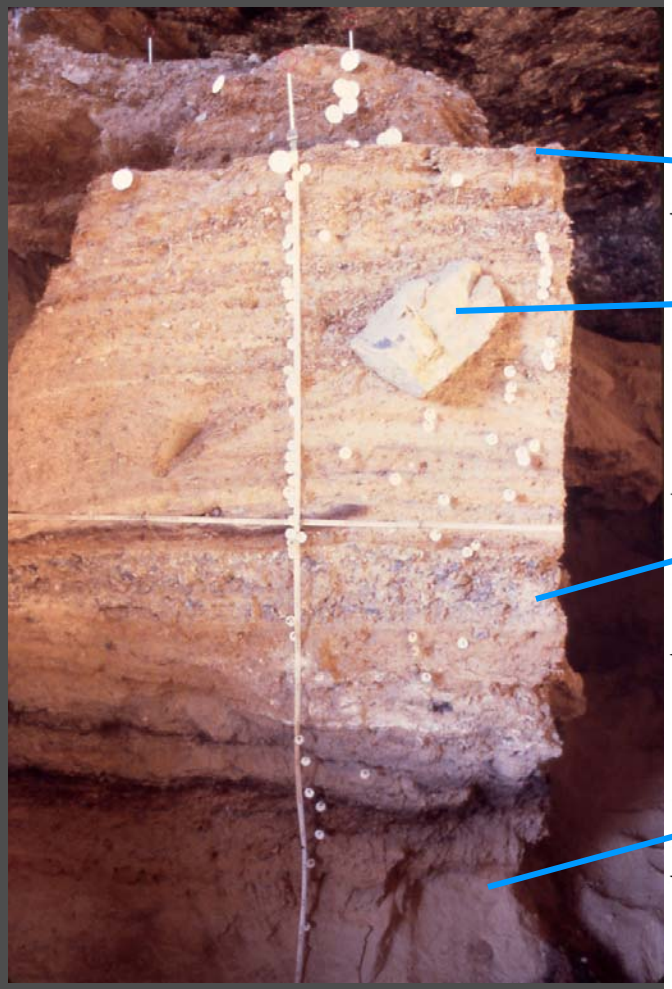


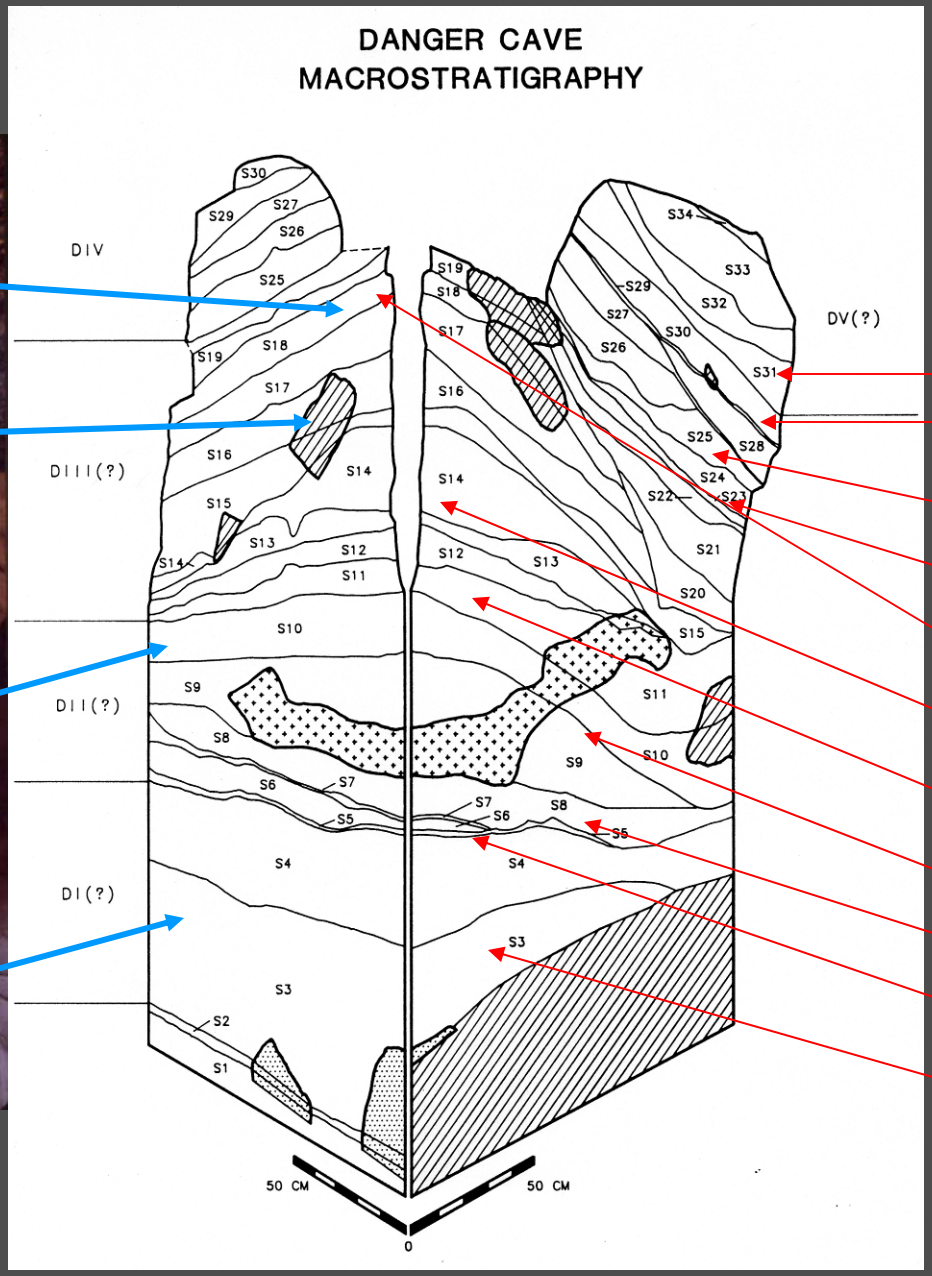
Danger Cave
F112 Hearth
10,270 ± 50 14C yr BP
(12,070 ± 198 Cal yr BP)

Figure 4. Danger Cave Stratigraphy – 2001/2002




Grid North-South Line
Limit of Cultural Fill
DANGER
CAVE,
UTAH
Back Trench
1968
Recent
Exposures
2001-4
143 Face
Jennings
1949-53
4 m approx
Madsen
1986
Smith 1940





2640 ± 90

4860 ± 110

5140 ± 100

5330 ± 70

6020 ± 50

6710 ± 70

7490 ±120

7920 ± 80

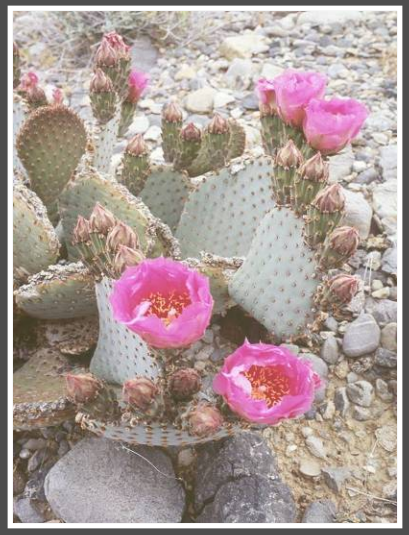
8410 ± 50

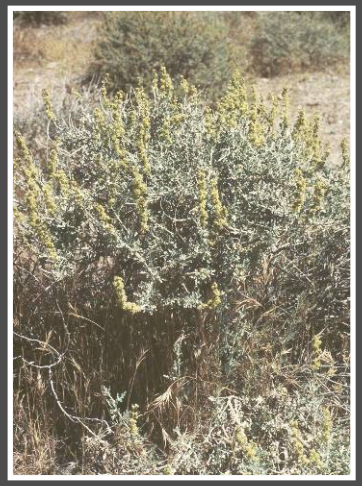
10,080 ± 130

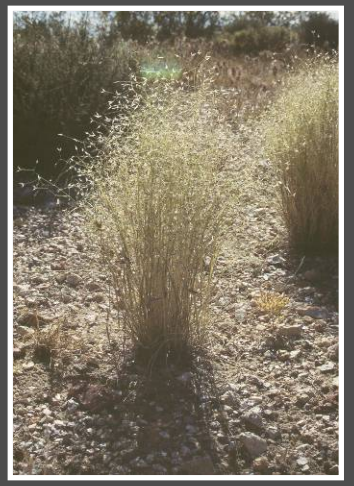
9890 ± 185

Figure 7. Artifacts Recovered from 2002 Danger Cave Excavations (in Backfill)

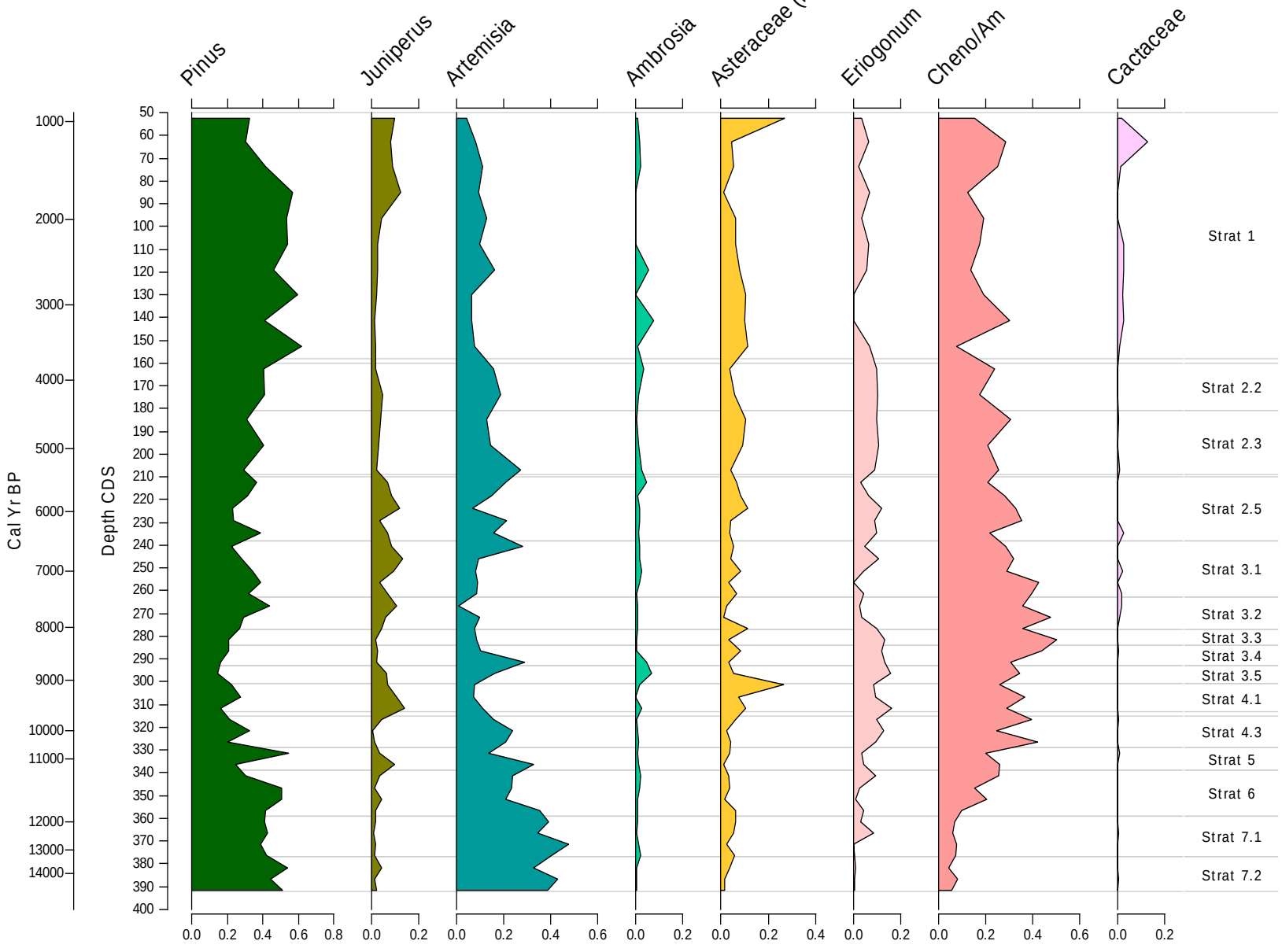
Middle Holocene Food Plants from Bonneville Estates Rockshelter







Holocene Vegetation Changes
Blue Lake, western Utah




Thanks for listening!