THE APPLICATION OF OSL TO DATING PREHISTORIC SURFACE-FAULTING EARTHQUAKES ALONG THE WASATCH FRONT URBAN CORRIDOR: A CASE STUDY AT THE PENROSE DRIVE SITE, SALT LAKE CITY, UTAH

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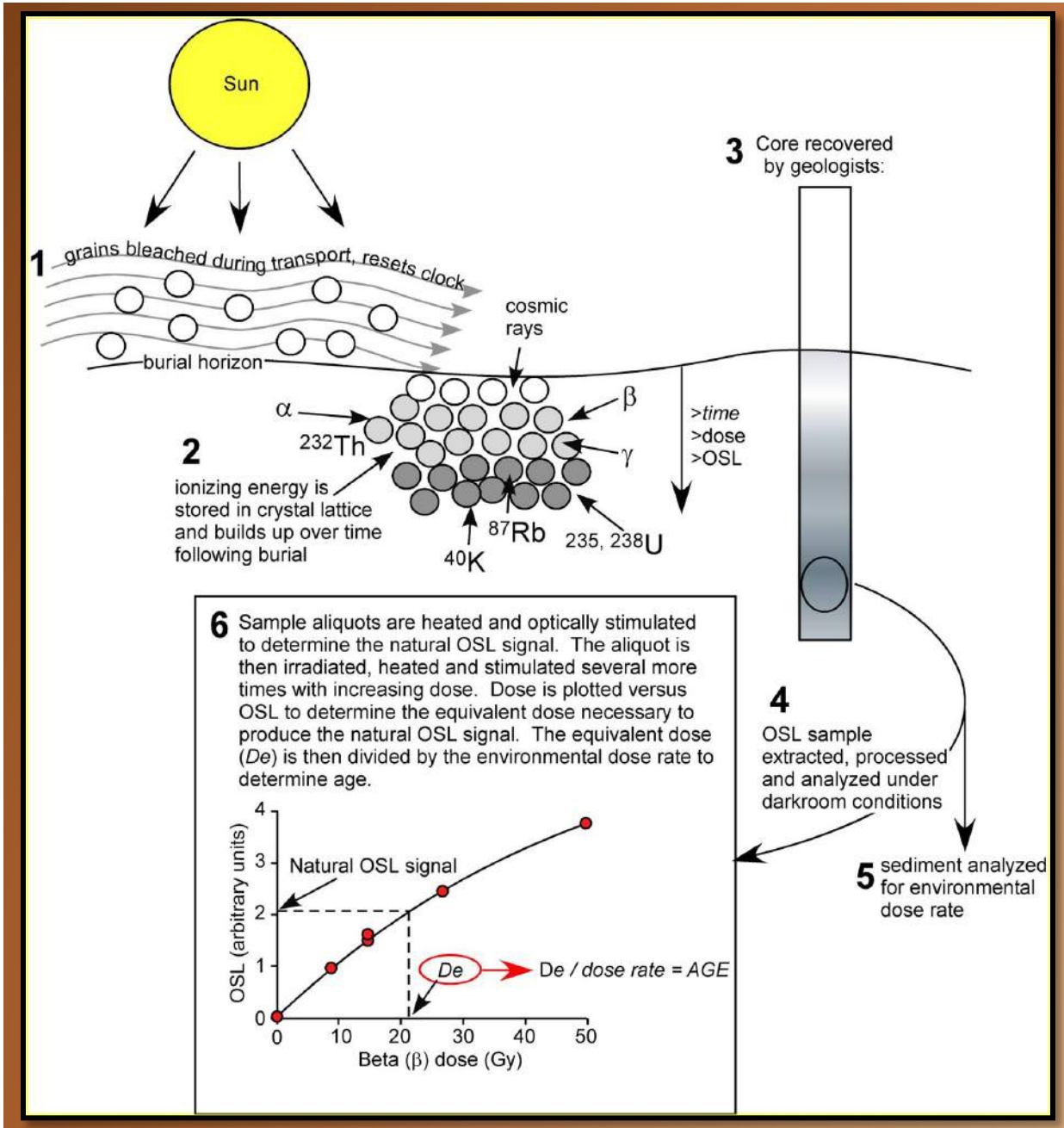
UTAH DEPARTMENT OF Natural Resources



Picture courtesy of Dave Mallinson, East Carolina University

ANOTHER WAY TO EXPLAIN LUMINESCENCE DATING

- **It is not an isotopic decay method, instead measures growth of a signal**
- **Only measures the last depositional event of the grains**
- **Assumes complete resetting along the path to deposition but this assumption can be tested and measured**

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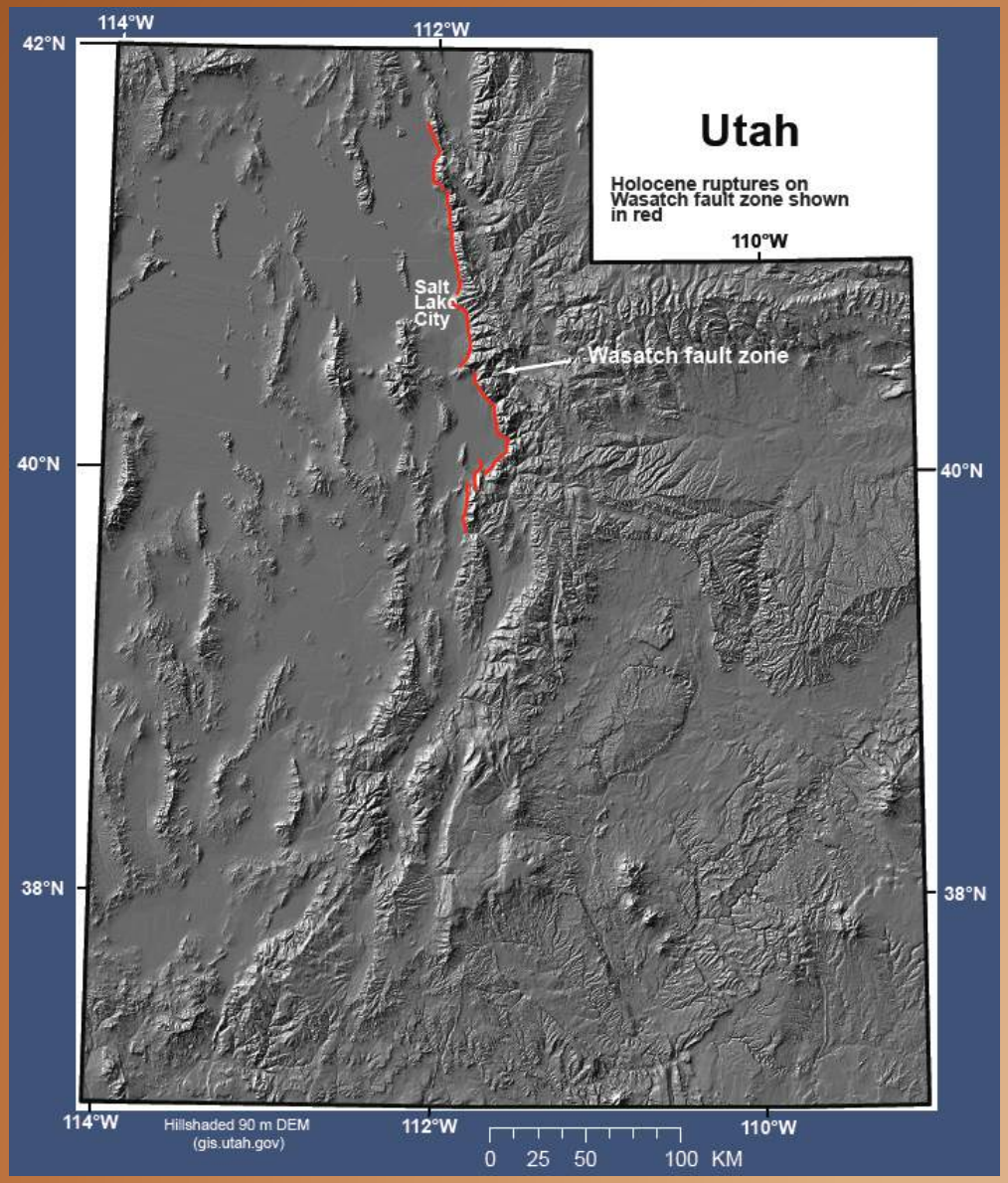
What is the best mineral for luminescence dating in Utah?

Quartz		K-Feldspar	
Advantage	Disadvantage	Advantage	Disadvantage
Highly resistant to weathering	Relatively low luminescence intensity; some quartz samples do not emit measurable luminescence	Luminescence saturates at a higher radiation dose than does that from quartz	Weathers more readily from the environment than does quartz
Luminescence signal bleaches more rapidly in sunlight than that from feldspar	Luminescence saturated at lower radiation doses compared to that emitted from feldspar	Luminescence intensity may be orders of magnitude higher than that emitted from quartz	Suffers from anomalous fading and each sample must be tested and corrected for this
Does not appear to suffer from anomalous fading	Thermal transfer can be higher in quartz than in feldspar	IRSL can be stimulated preferentially in quartz-feldspar mixtures	Difficult or impossible to correct for sensitivity change in regenerative dose data when using SAR

From Lian, Encyclopedia of Quaternary Science, 2007

Problems one might encounter in dating Wasatch Fault Zone sediments with luminescence: Case Study



Map of Utah showing extent of Holocene ruptures on the five central segments of the Wasatch fault zone.

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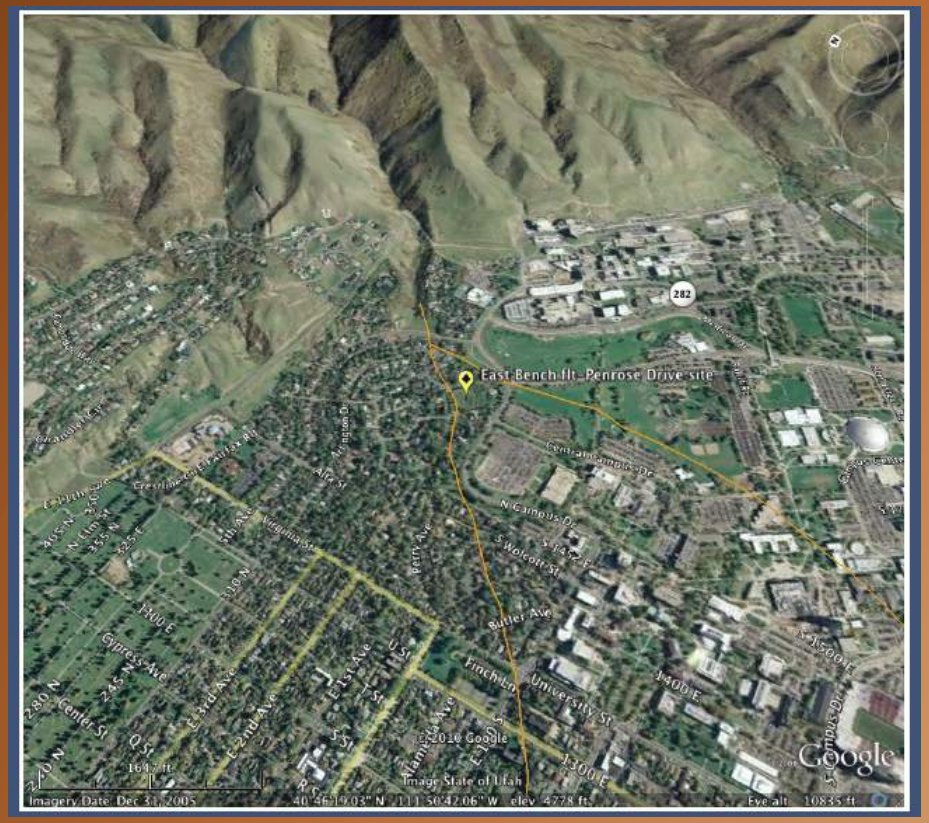
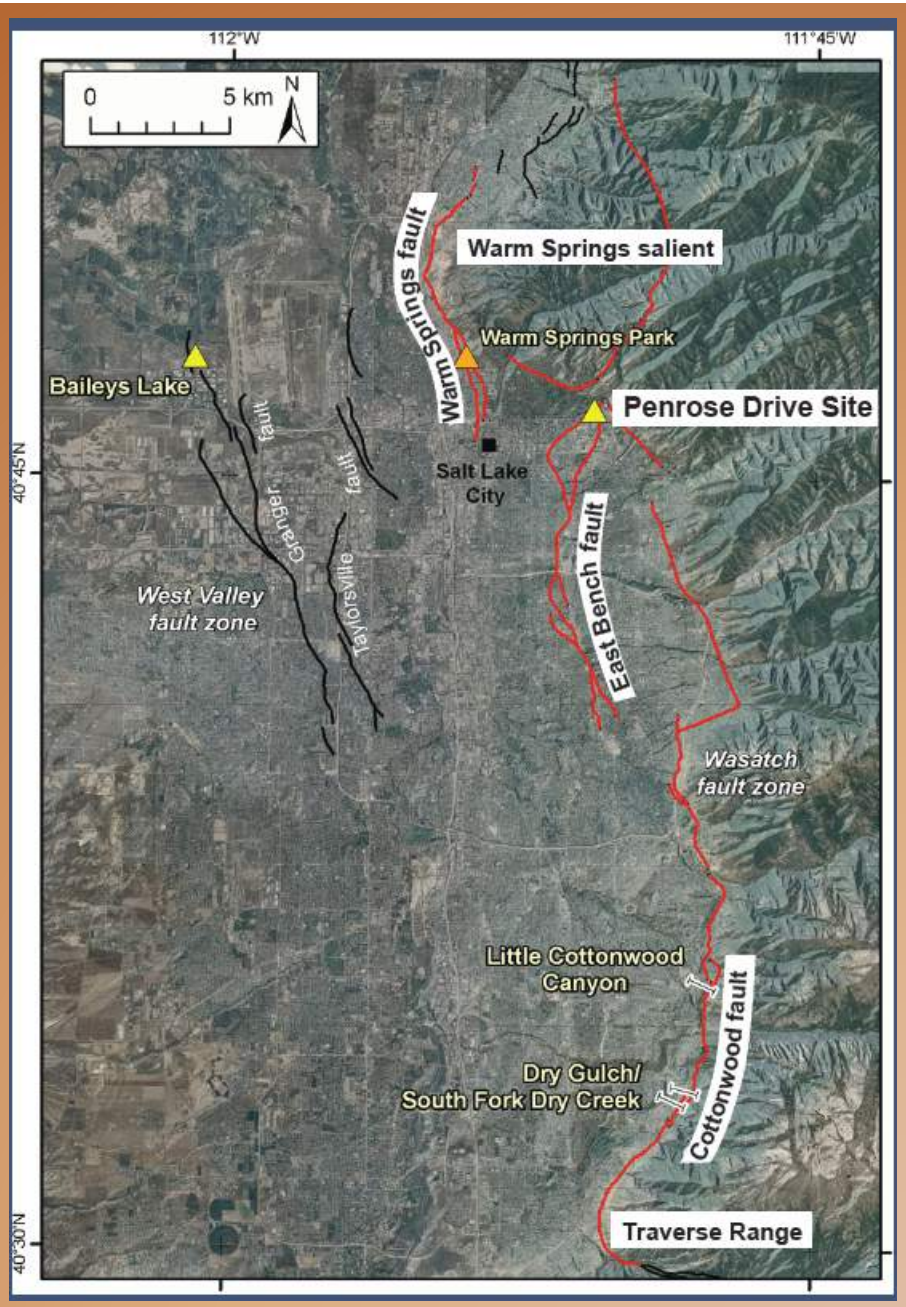


Oblique Google Earth view of the Penrose Drive trench site in northeast Salt Lake Valley. Yellow lines are fault traces from the USGS Quaternary fault-and-fold database.



Map of Salt Lake Valley showing salients and three fault strands of the Salt Lake City segment.

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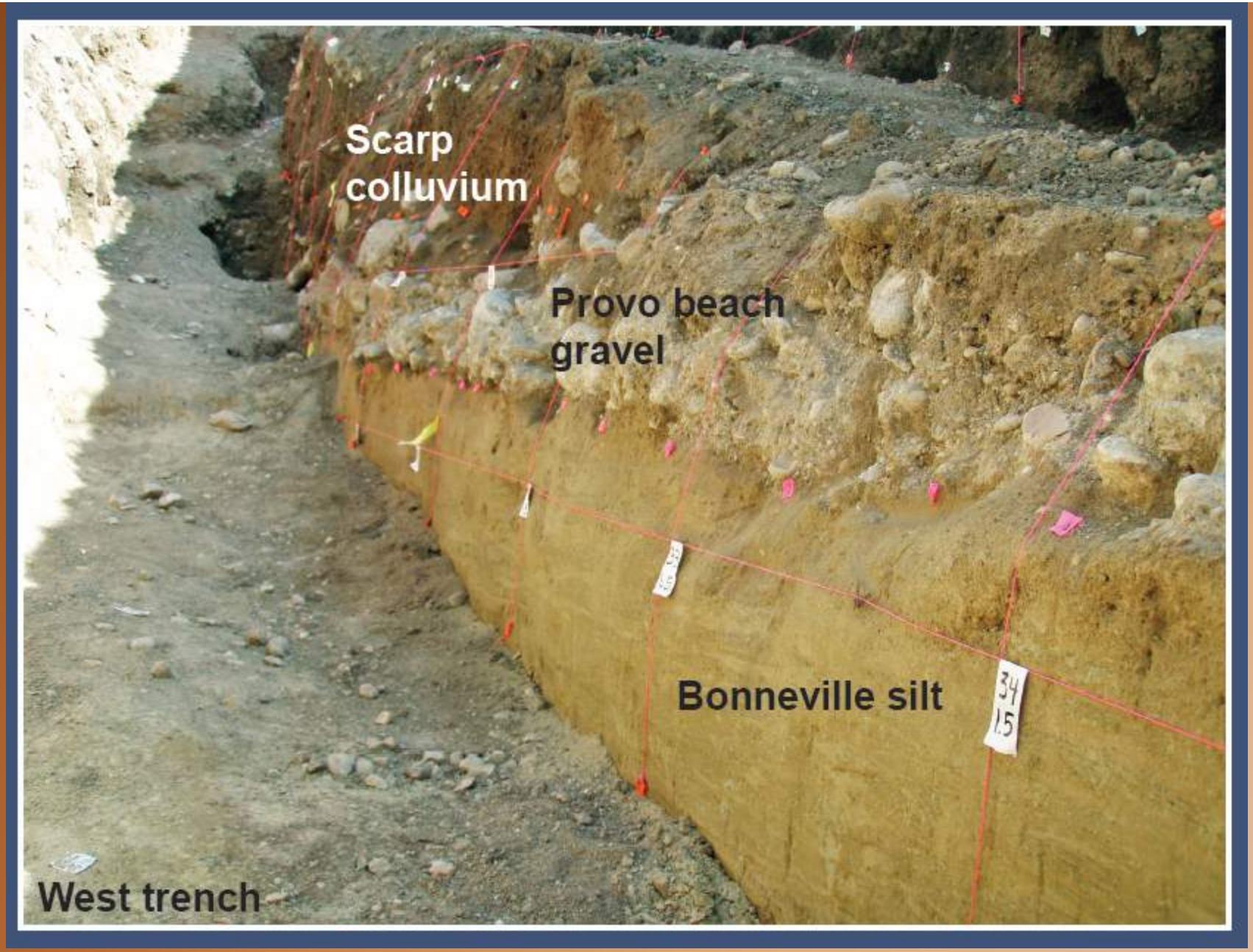
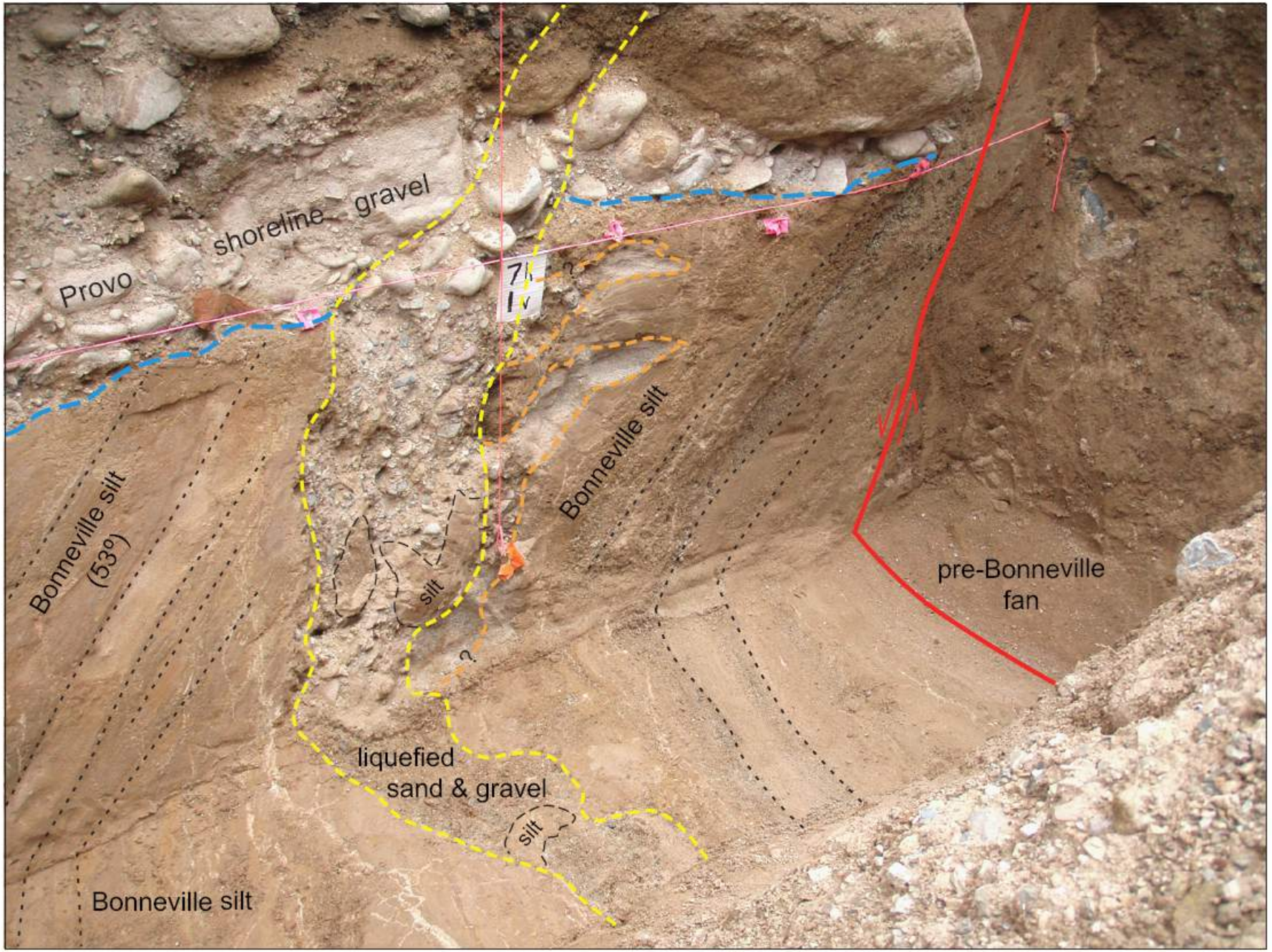
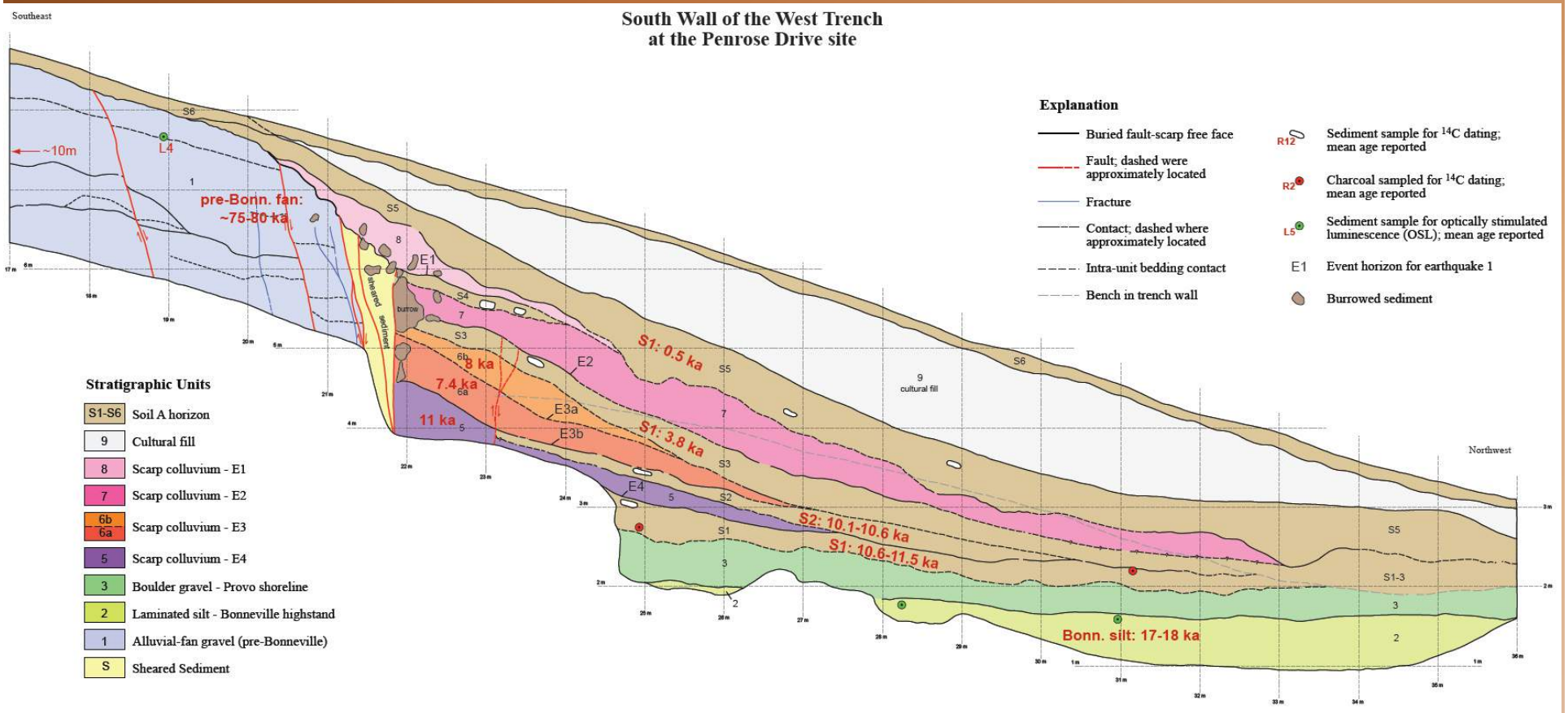
Note the shortened travel path the sediments incorporated in the colluvial wedges must travel before being redeposited. Horizontal and vertical lines are 1 m apart.



Although the west trench shows flat-lying, undeformed beds, the east trench shows an angular unconformity and tilting (subaqueous faulting?)


Provo
shoreline
gravel
Bonneville silt
(53°)
Bonneville silt
silt
?
Bonneville silt
pre-Bonneville
fan
liquefied
sand & gravel
silt
Bonneville silt

What part of the fault-related deposits are best to date along the Wasatch Fault Zone?



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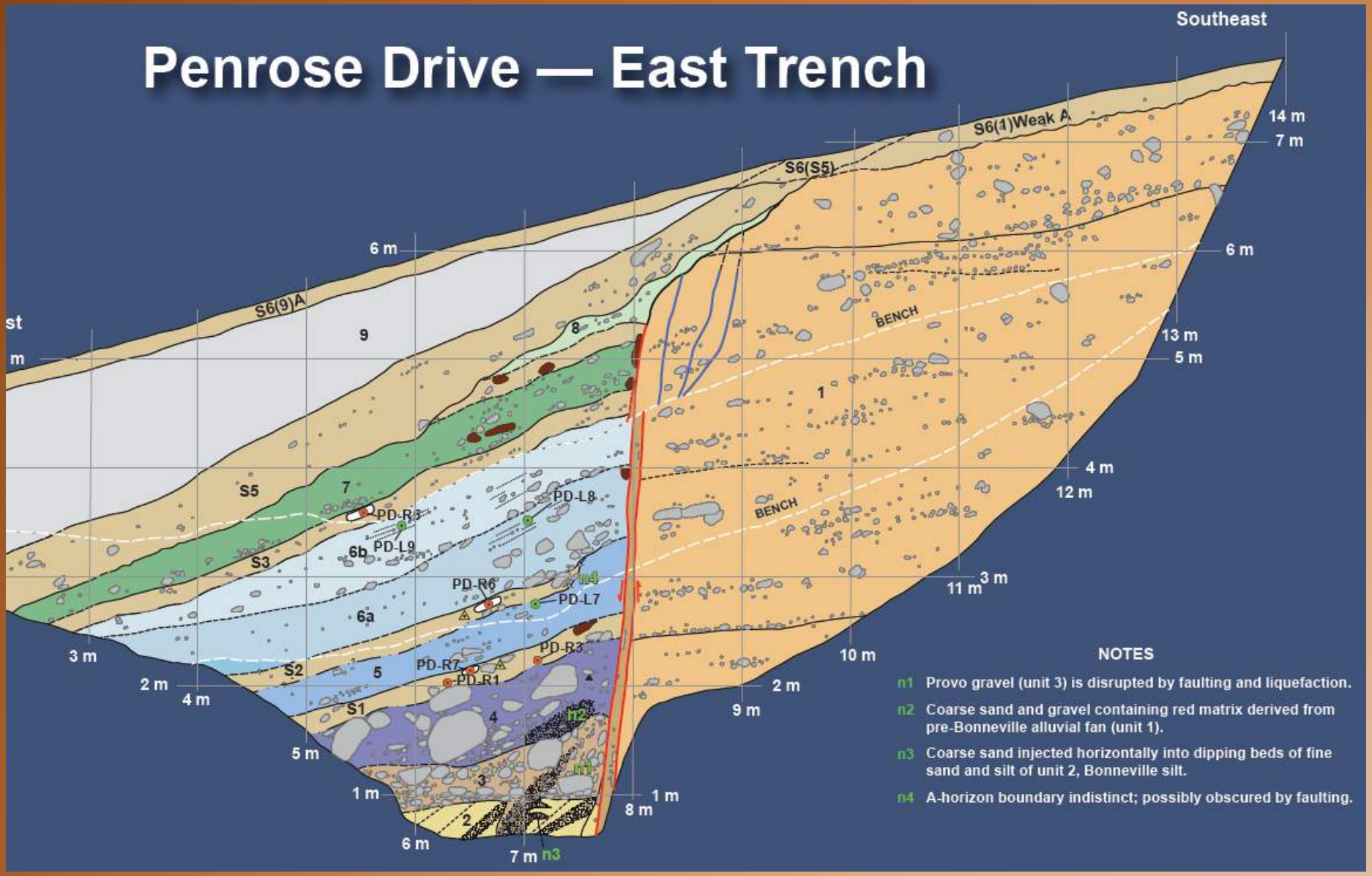

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How do Radiocarbon and OSL results generally compare in these studies?

- ❖Within scarp colluvium no direct comparison
- ❖Stratigraphic agreement, duplication of OSL and IRSL
- ❖Luminescence saturation within the oldest alluvial fan layer

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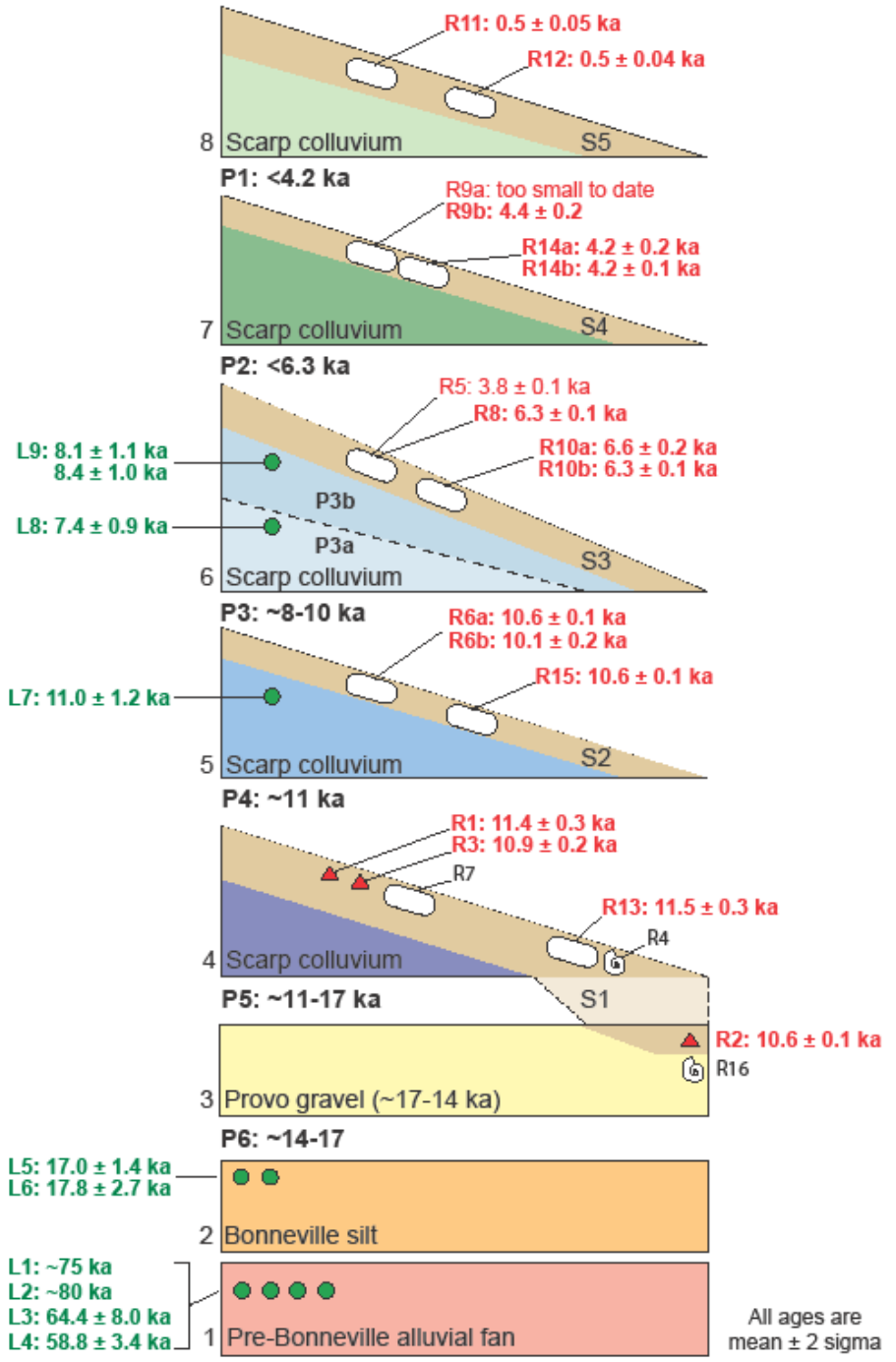

Conclusions

- Even under the best of conditions, with a low dose rate, luminescence can saturate out at around 75,000 years for quartz when dating the Wasatch Fault Zone sediments.

- The agreement between radiocarbon and luminescence is good, although direct comparisons are rare.

- Despite the "messiness" and short travel path of colluvial wedges, reliable ages can be obtained for quartz and, in a limited context, for feldspar.

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