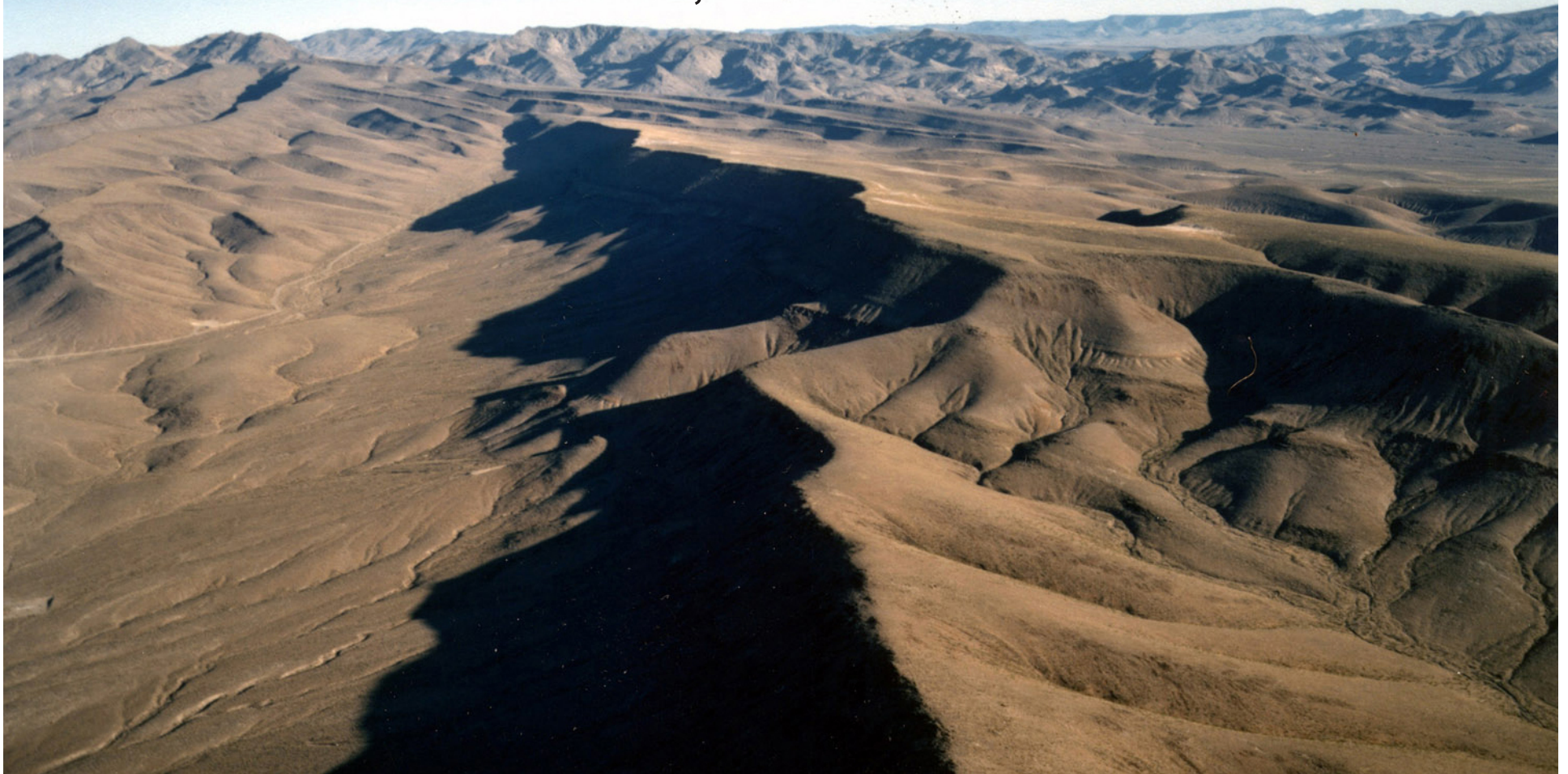


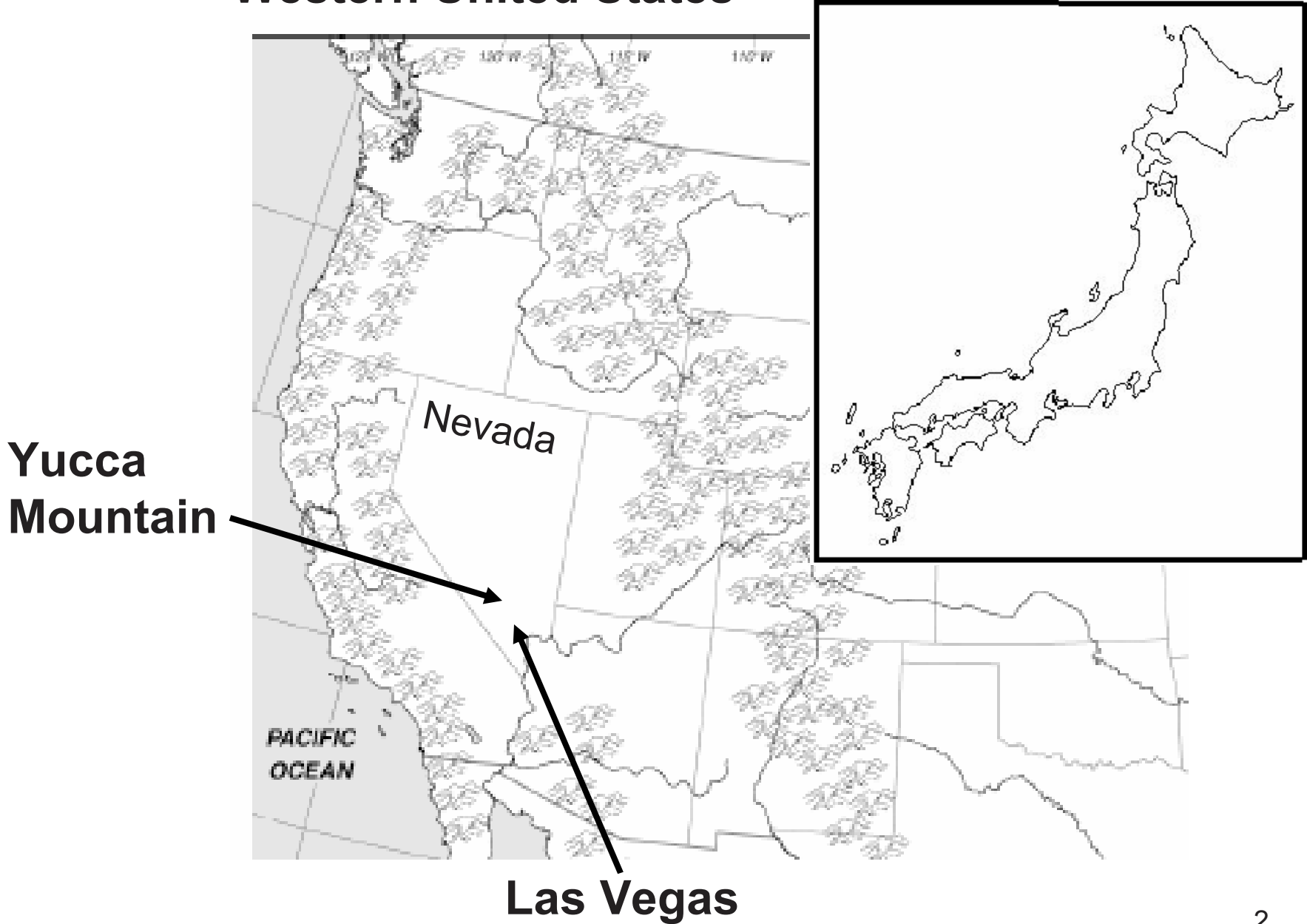
# **Geology and Engineered Barriers for the Proposed Yucca Mountain High-Level Waste Repository**

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# Western United States



# Important Long-Term Issues

- Effects of corrosion, rock fall, and welding on life of waste packages and drip shields
- Rates of radionuclide release from packages
- Uncertainties in model predictions over thousands of years
- Consequences of volcanism penetrating a repository (low risk  $<10^{-7}/\text{yr}$ )
- Waste package environment (combined effects of heat, water, and chemistry)
- Stability of tunnels

# ACNW Review Focuses on Realism in Science and Engineering – The Risk Triplet

- What can go wrong?
- How likely is it?
- What are the consequences?

# Items of High Significance to Waste Isolation

- Persistence of a passive film on waste package surfaces
- Unsaturated zone groundwater seepage rate
- Chemistry of water contacting waste packages
- Retardation of radionuclides in alluvium
- Probability of igneous activity
- Number of waste packages affected by volcanic eruption
- Resuspension of contaminated volcanic ash

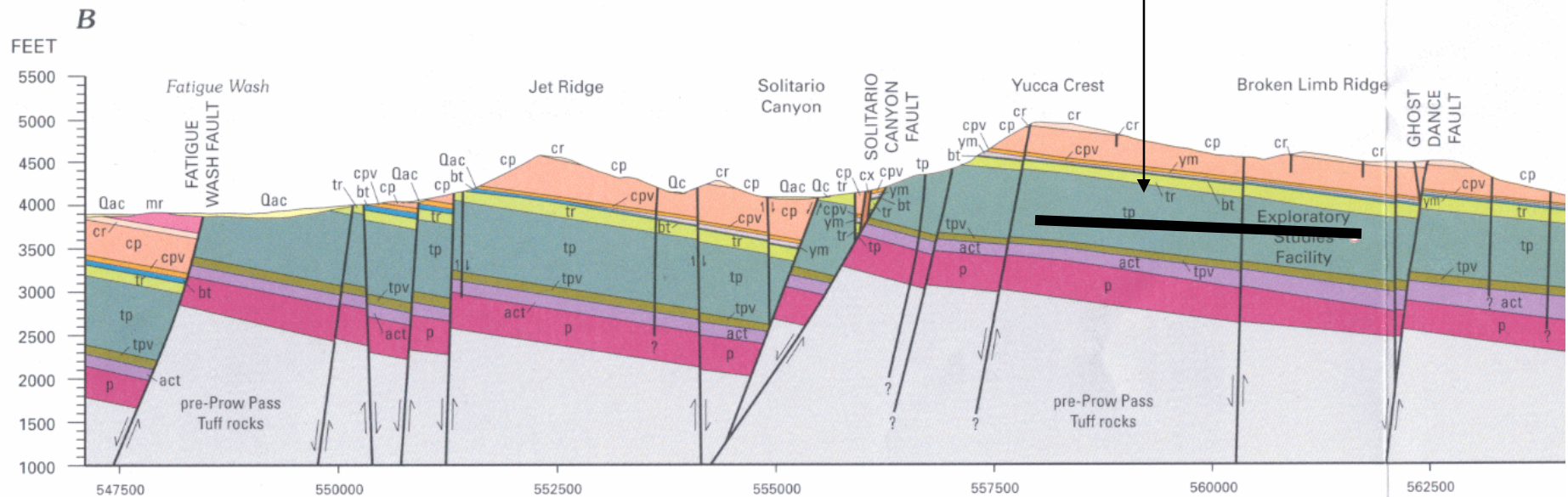
# Geomorphology

The landforms in this region were created by a complex history of:

Miocene volcanism and faulting (13 – 5 million years ago)

Pliocene and Quaternary faulting (5 million years to present), small basaltic volcanos, flash flood erosion, and deposition of sediments in deep basins

## Proposed repository



For legibility, undivided units bt, tr, tp, ac, and p are used on this cross section as follows:  
 bt includes bt3, pp, and bt2; tr includes trv and trn; tp includes tpul, tpmn, tpil, tpIn, and tpv;  
 ac includes act and acl; and p includes p and pbt.

Volcanic rocks were formed 13 million yrs ago by pyroclastic flows and thick volcanic ash. Then the region experienced normal faulting (pull-apart) that produced basin and range topography.

**Regional studies suggest the probability of future volcanism is sufficiently high that NRC has required DOE to evaluate consequences of possible dike intersection.**





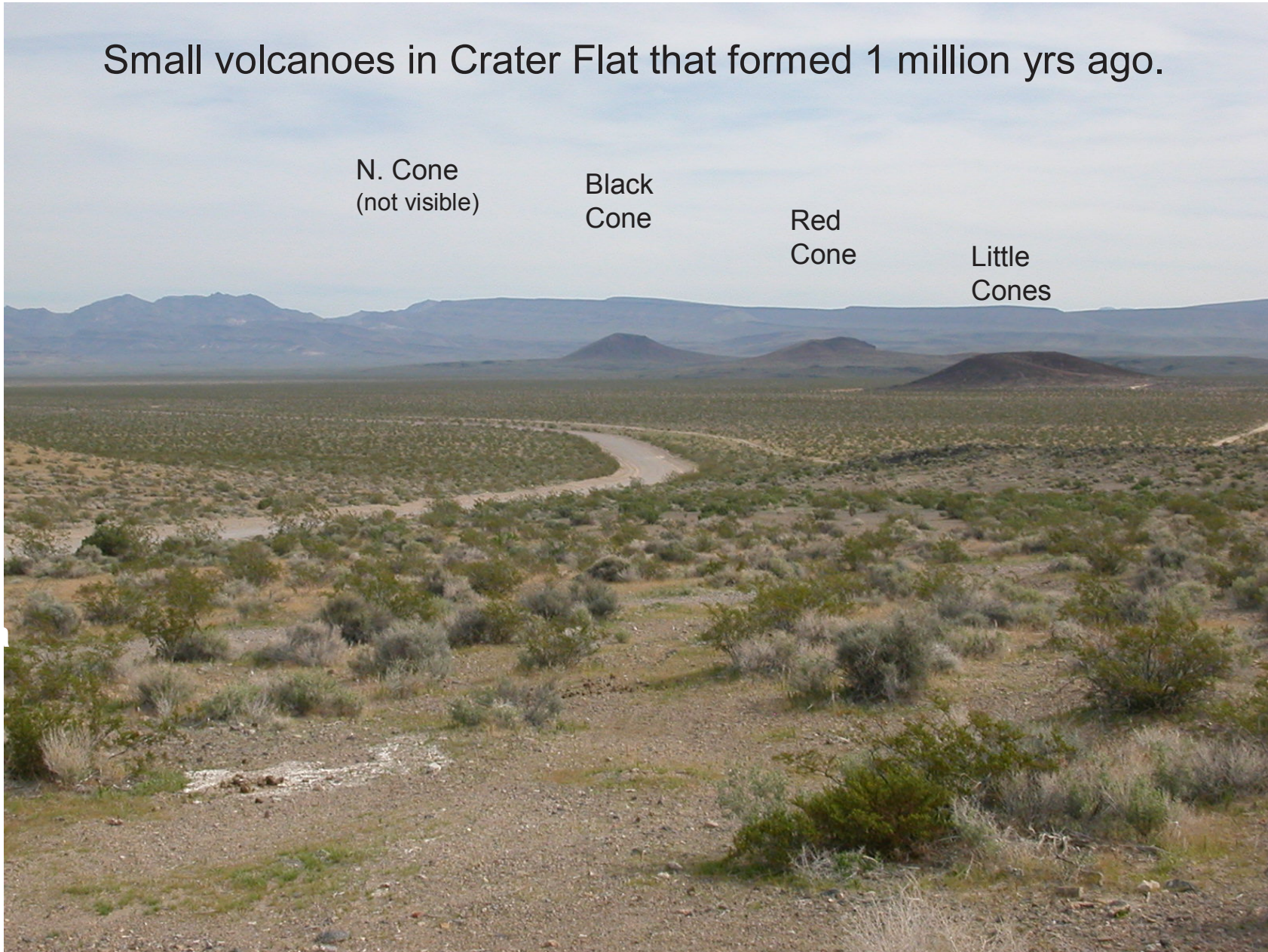
Small volcanoes in Crater Flat that formed 1 million yrs ago.

N. Cone  
(not visible)

Black  
Cone

Red  
Cone

Little  
Cones



## Amargosa Desert

## Funeral Mountains



Climate change in this region is well understood. These white deposits are 12 km southwest of Yucca Mountain. They show where springs flowed more than 12,000 yrs ago. The springs no longer flow.



**Fairbanks Spring,  
Ash Meadows,  
Nevada**

What spring in previous slide probably looked like 20,000 yrs ago.

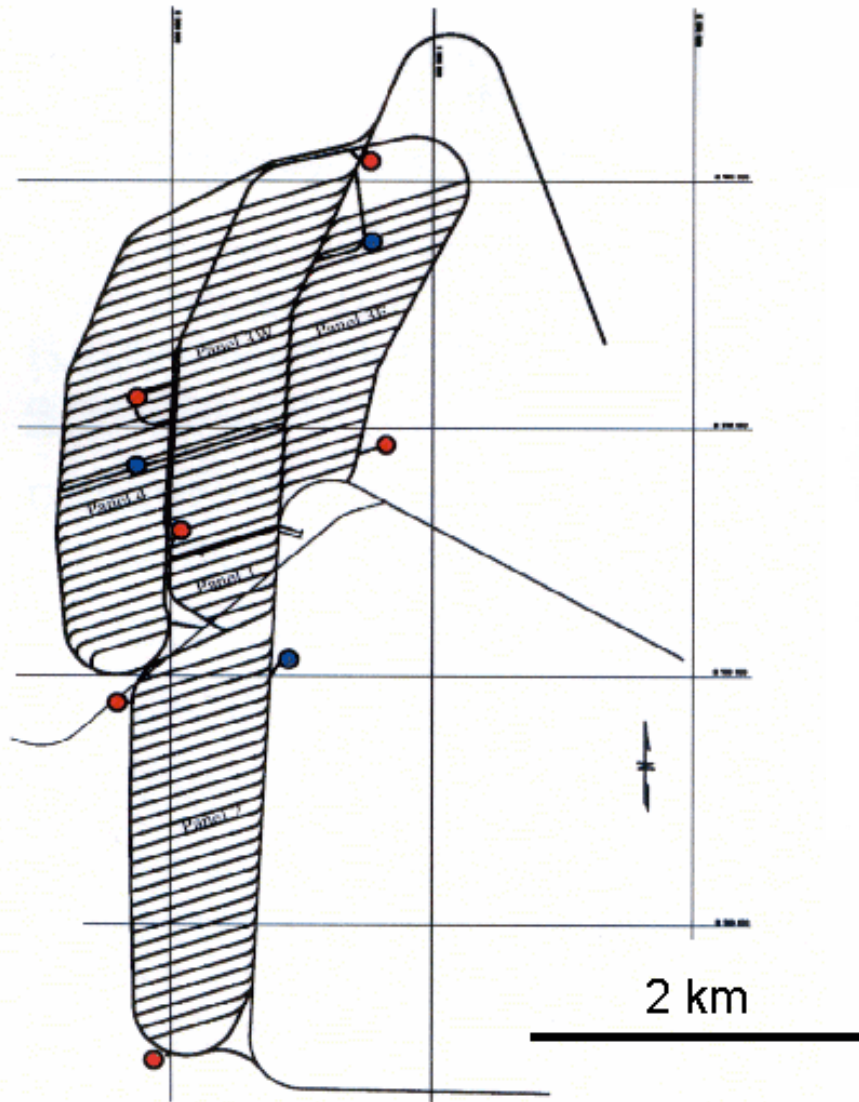


**The tunnels at Yucca Mountain were constructed using tunnel boring machines.**



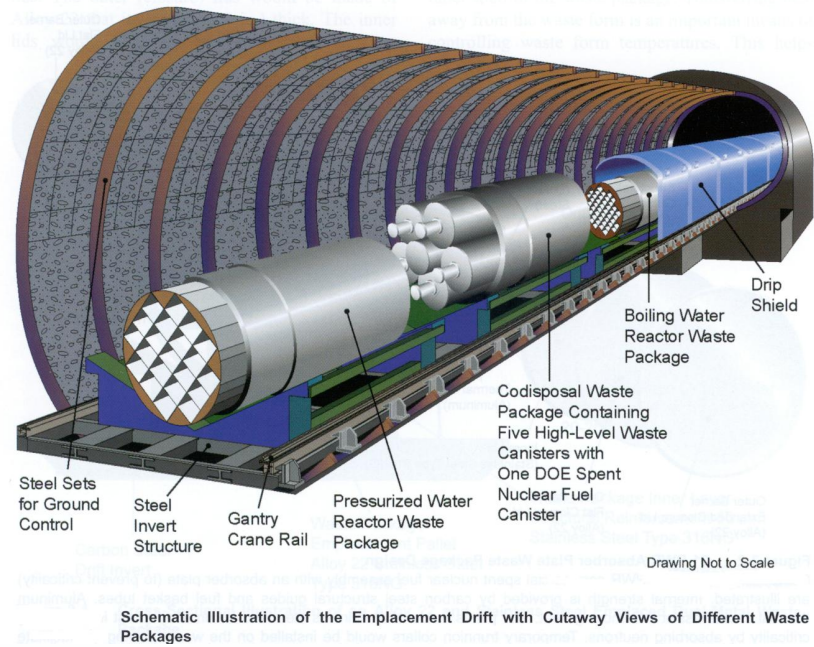
**In main tunnel 300 m below ground surface.**

## Currently proposed footprint (~6.9 km<sup>2</sup>)



(Credit: U. S. DOE)

## Waste emplacement drift



(Credit: U. S. DOE)

# Time of Compliance

On July 8, 2004, a U.S. Court of Appeals set aside the 10,000 year compliance period for Yucca Mountain.

The U.S. Environmental Protection Agency must now change the radiation standards for Yucca Mountain. NRC will then revise its regulation (10 CFR Part 63) to include the EPA standard.

# Time of Compliance

The ACNW is:

- reviewing its previous recommendations,
- gathering information on current concepts and views, and
- waiting for the US Environmental Protection Agency's draft standards (expected 2005).