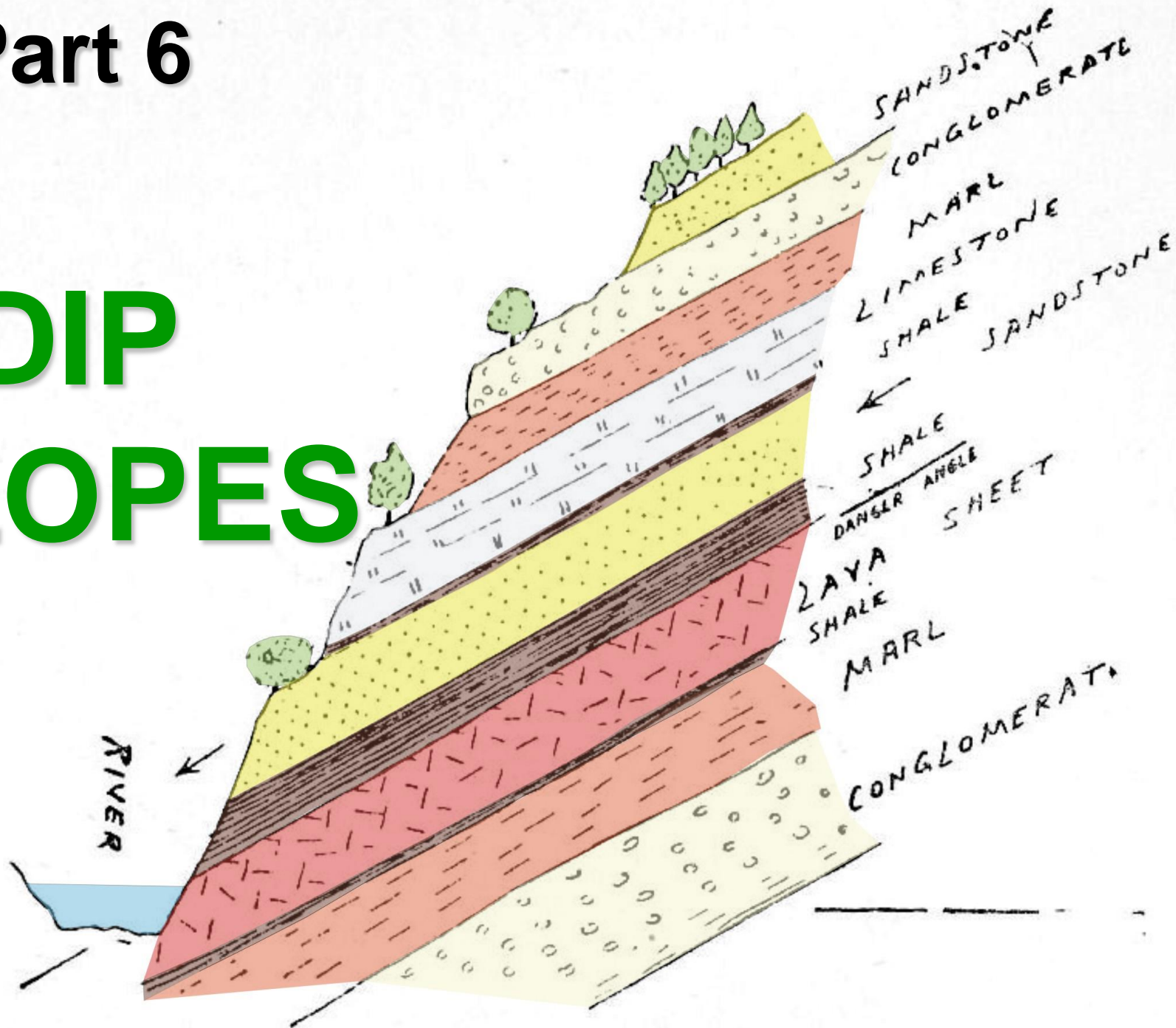
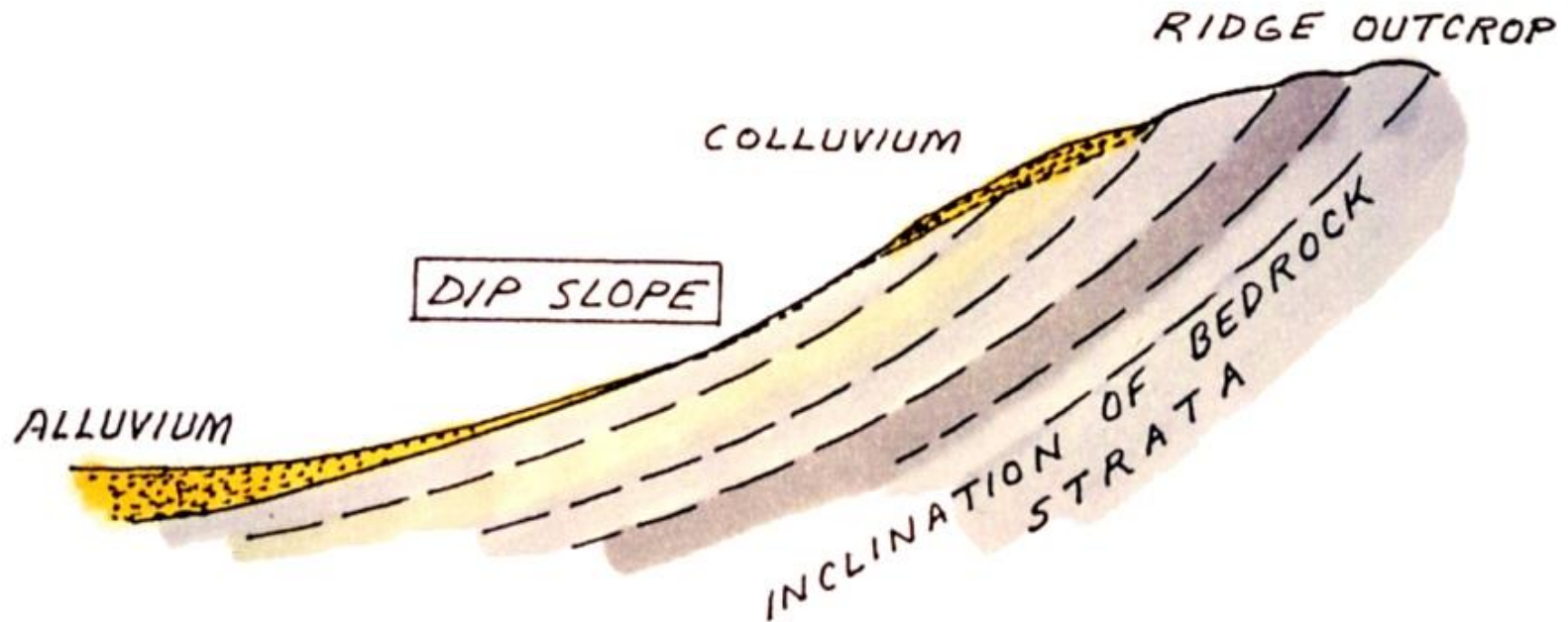


# Part 6

# DIP SLOPES



# CLASSIC DIP SLOPES



- **Dip slopes** are situations where the underlying strata are inclined semi-parallel to the natural slope
- Dip slopes can exist in either bedded or foliated strata

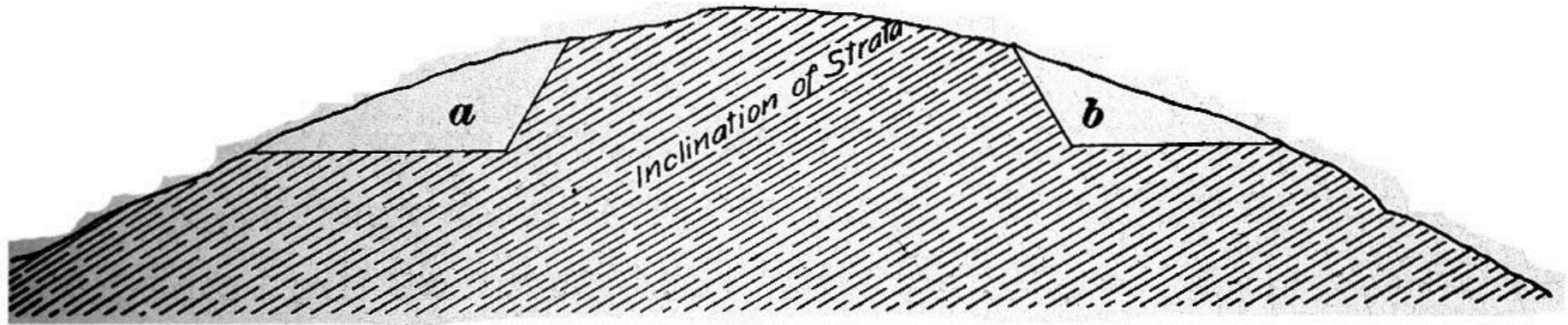
# DIP SLOPES and ANTI-DIP SLOPES



*STRUCTURAL CONTROL OF SLOPE FORM BY UNDERLYING GEOLOGY*

- Dip slopes tend to form long, gradual ridges and may foment enormous slope failures
- Obsequent, or anti-dip slopes, tend to be steeper, but not as long. About 70% of slope failures occur on anti-dip slopes, but these tend to be of much smaller volume than dip slope failures.

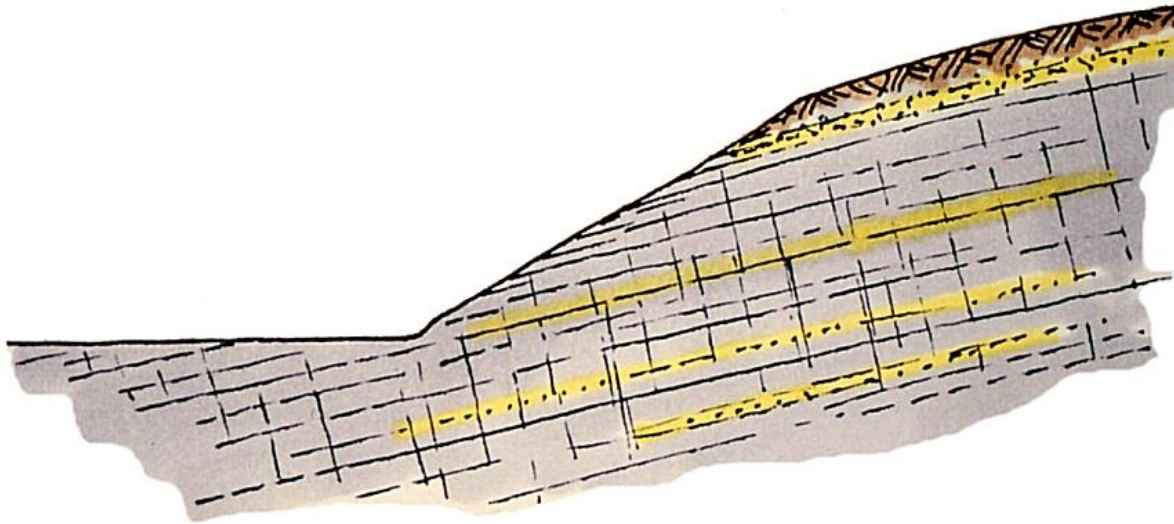
# Adverse Dip Slope Conditions



- **Excerpt from Int'l Correspondence School text on civil engineering published in 1908 illustrating how planar strata dipping into an excavation at left was considered “adverse” to long-term stability and/or erosion; in contrast to the condition at right.**

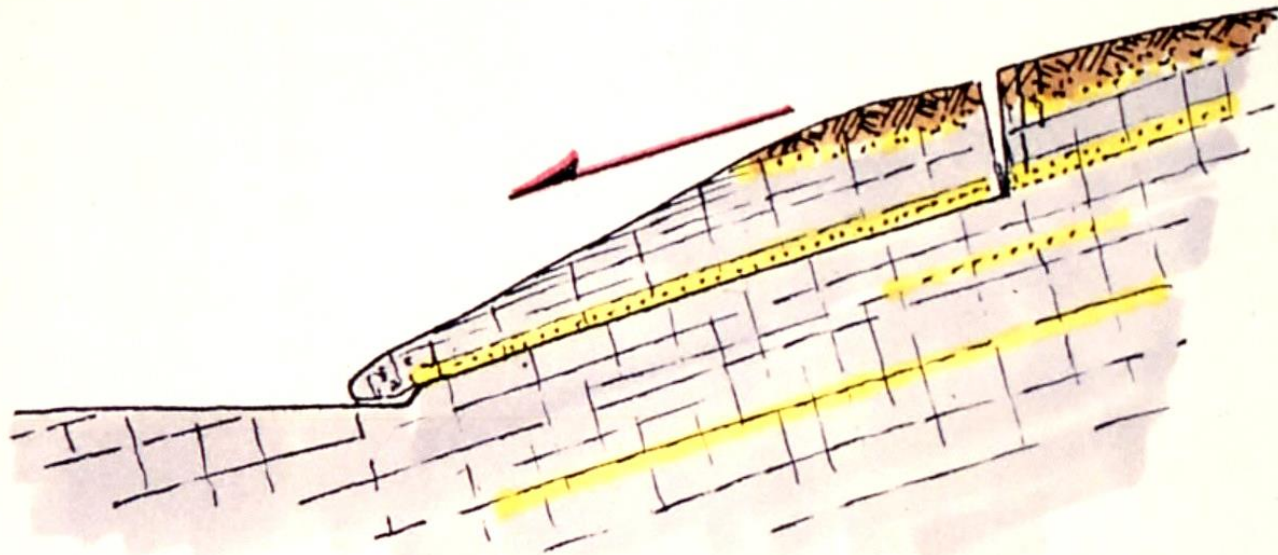
# DAYLIGHTED CUT SLOPES

*OUT-OF-SLOPE DIP*



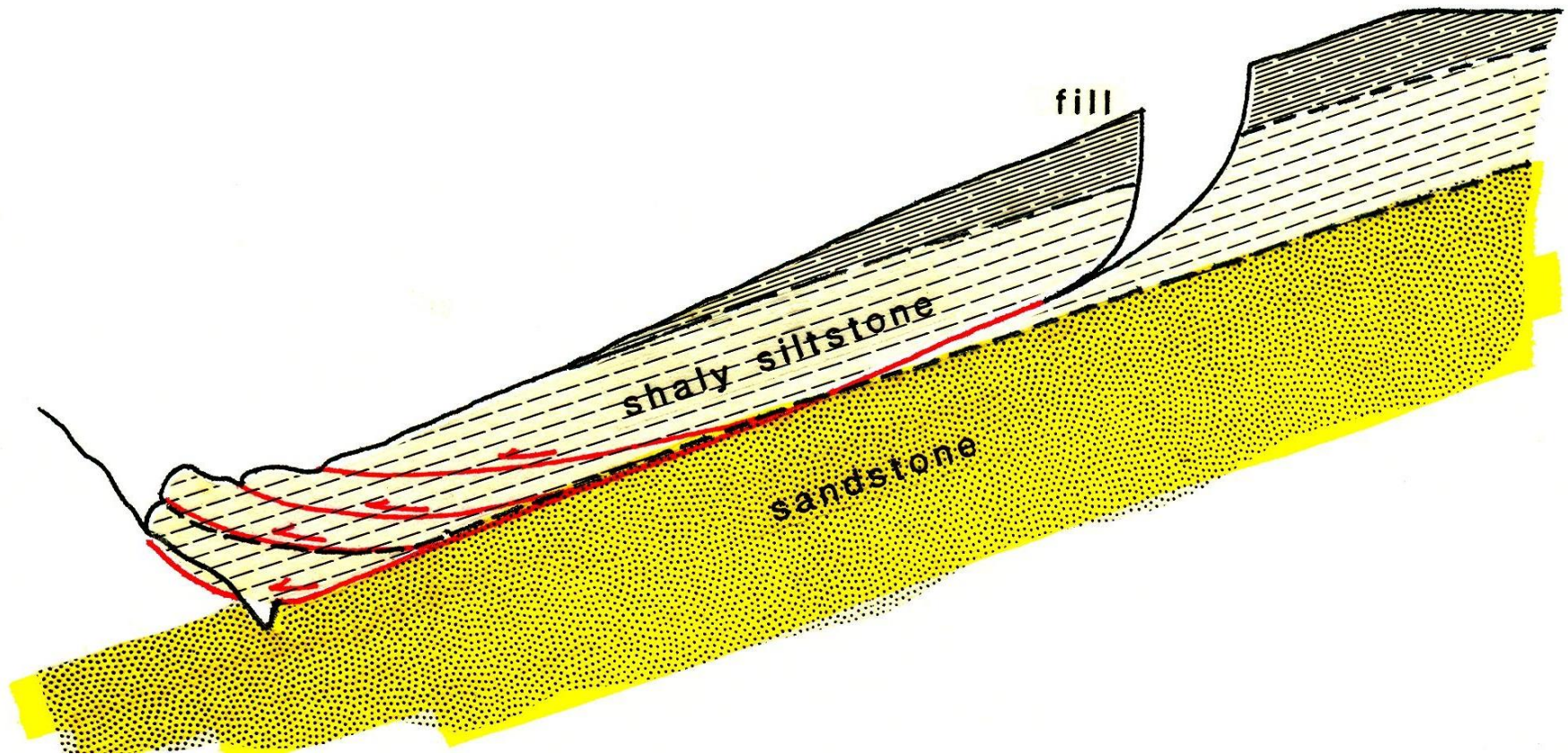
- **When excavations are made into dip slopes or slopes with upward inclined strata, potential planes of weakness are truncated and exposed. These are called out-of-dip or daylighted cut slopes**

# SLIPPAGE OF DAYLIGHTED BLOCK

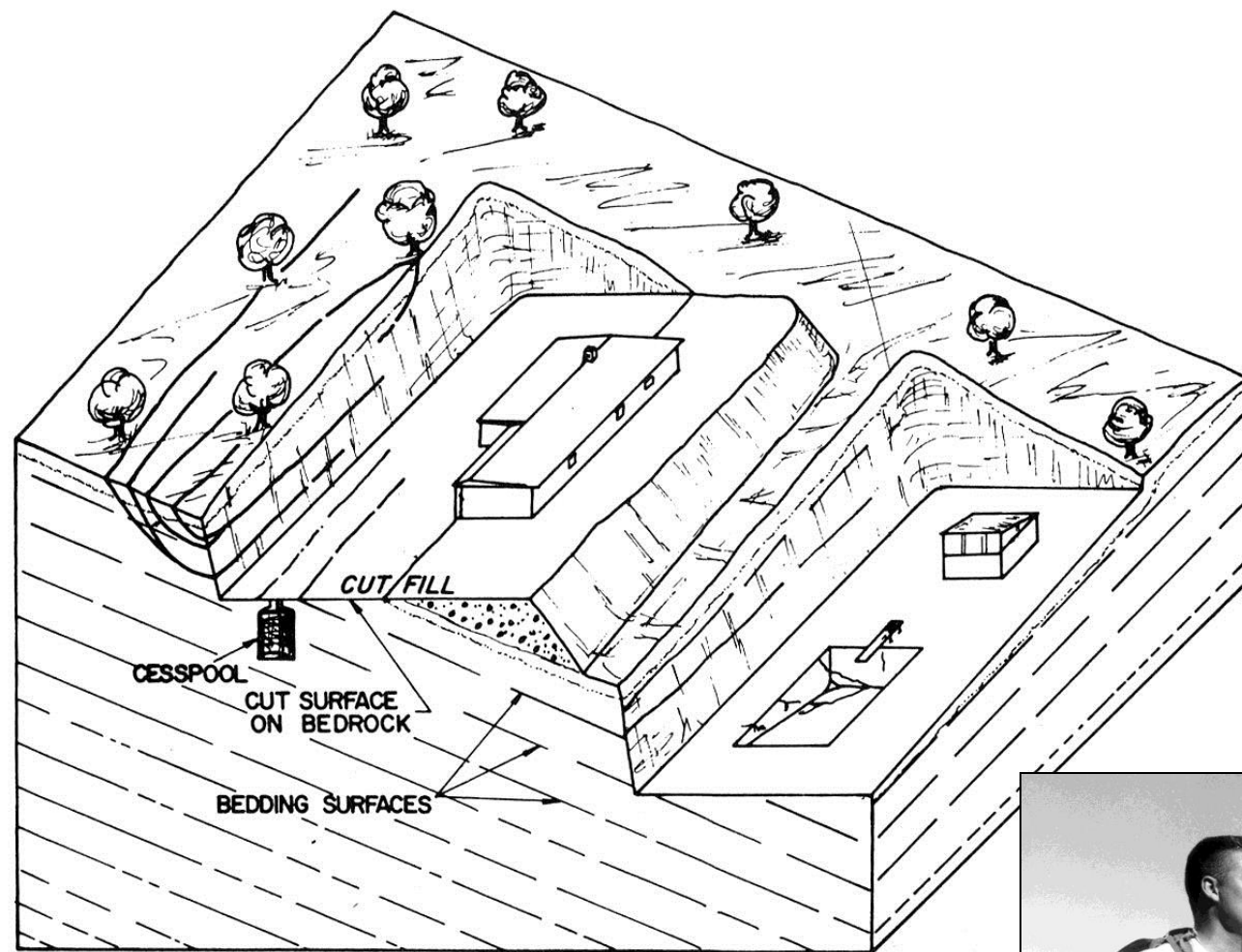


DAYLIGHTED BLOCK MOVES ALONG GEOLOGIC DISCONTINUITY  
INTO EXCAVATED AREA

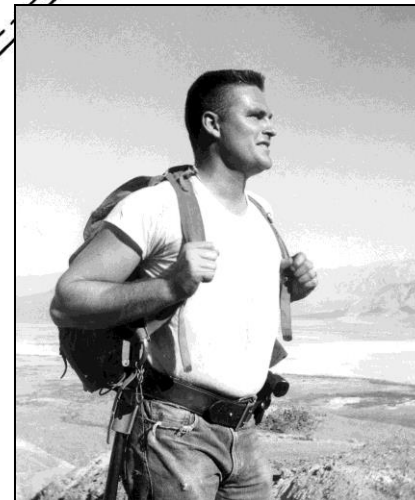
- Daylighted blocks can translate downslope if the slope has not been buttressed in some way. Such failures are common during construction, usually along contacts between dissimilar materials



- Many dip slope failures are ascribable to **strain incompatibility** between materials of contrasting permeability or stiffness, such as sandstone and shale.



Caltech Geology Professor Richard H. Jahns (1915-83)



Orange County Geologist Mike Scullin (1932-95)



Consulting Geologist Dr. James E. Slosson (1923-2007), who served as State Geologist in 1973-75

■ Geologists began drawing block diagrams, like this one by Dick Jahns in 1958, which show a daylighted dip slope cut failures in bedded sequences. Shale stringers usually played a dominant role in triggering these sorts of failures



# DIP SLOPE FAILURE



- **Dip slope failure caused by surcharging slope with unkeyed fill and excavating toe of slope for development. Failure occurred along inclined bedding plane.**