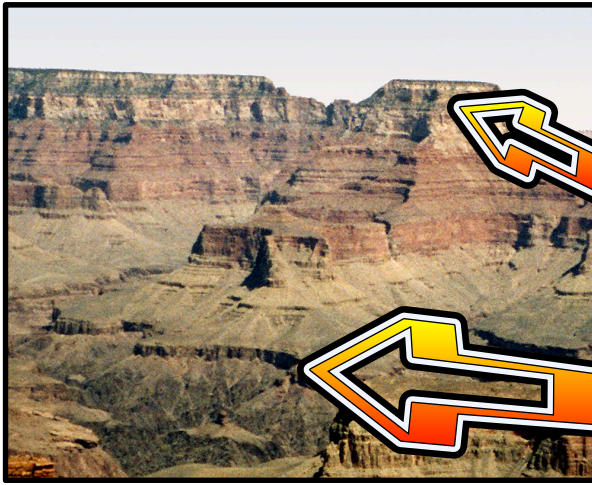


PART

4



WHICH WAY IS UP?

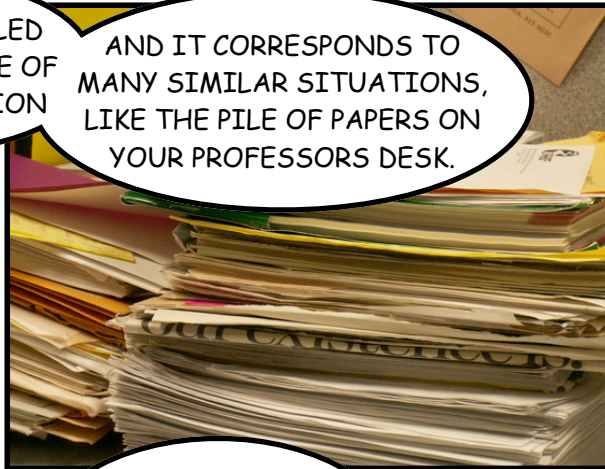
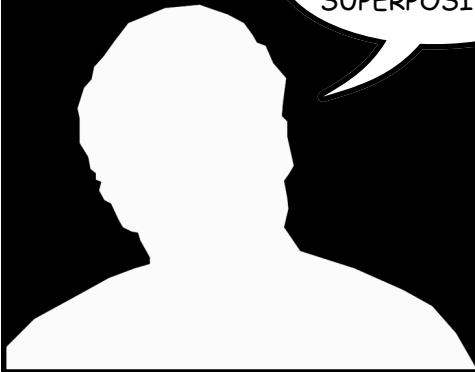


GEOLOGISTS USUALLY ASSUME THAT THE YOUNGEST LAYER (THE ONE FORMED MOST RECENTLY) IS THE ONE ON TOP OF A STACK OF HORIZONTAL LAYERS.

AND THOSE BENEATH ARE PROGRESSIVELY OLDER.

THIS IS CALLED THE PRINCIPLE OF SUPERPOSITION

AND IT CORRESPONDS TO MANY SIMILAR SITUATIONS, LIKE THE PILE OF PAPERS ON YOUR PROFESSORS DESK.



MEMO

Date: 1/1/2007

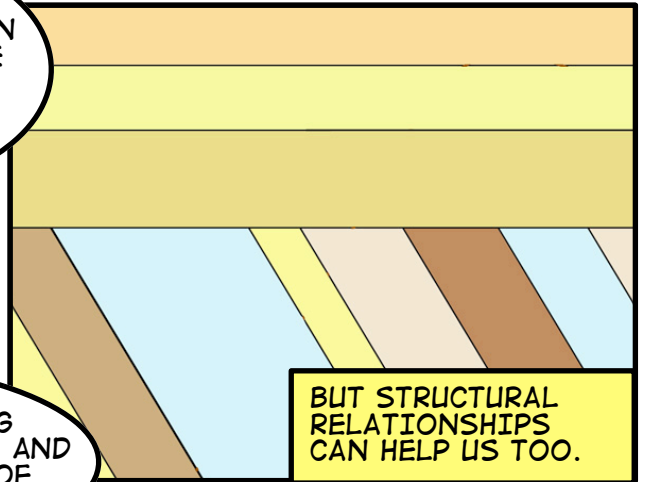
To: Chancellor R. U. Usetess
From: Dr. B. Throgmorton, Cha

Sir:

I must object to the pointless work involved in teaching classes. Classes should be focused on my own research and the vital job of advancing the Department of Pointless Studies.

YOUNGEST ON TOP,

THIS PRINCIPLE ACTS AS A GUIDE IN FIGURING OUT THE GEOLOGICAL HISTORY OF ANY REGION.



BUT STRUCTURAL RELATIONSHIPS CAN HELP US TOO.

Pointless Studies 101
Final Exam - Fall 1957

Name: Arthur Mae

1. Why do people always get

Because they are always doing what we do, and thinking that they are doing it better when they shouldn't.

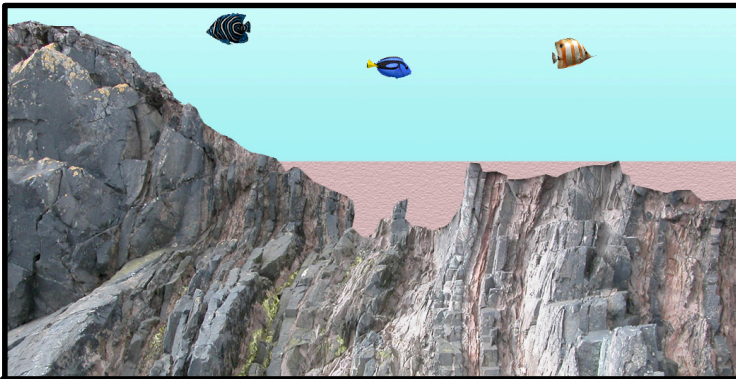
OLDEST ON THE BOTTOM. NOTE - NOT YET GRADED!

THIS OUTCROP SHOWS DIPPING ROCK LAYERS THAT END ABRUPTLY, AND ARE COVERED BY ANOTHER SET OF LAYERS WHICH ARE HORIZONTAL.

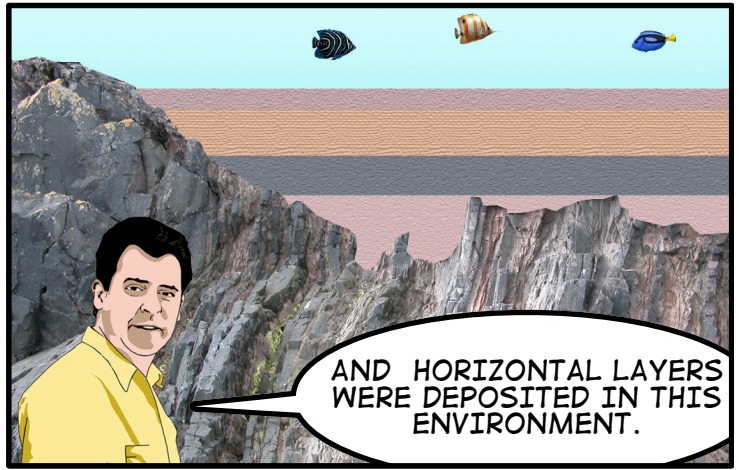


WE CAN IMAGINE THAT THE DIPPING LAYERS WERE ONCE CONTINUOUS, AND POSSIBLY PART OF A LARGE FOLD THAT WAS LATER ERODED AWAY.



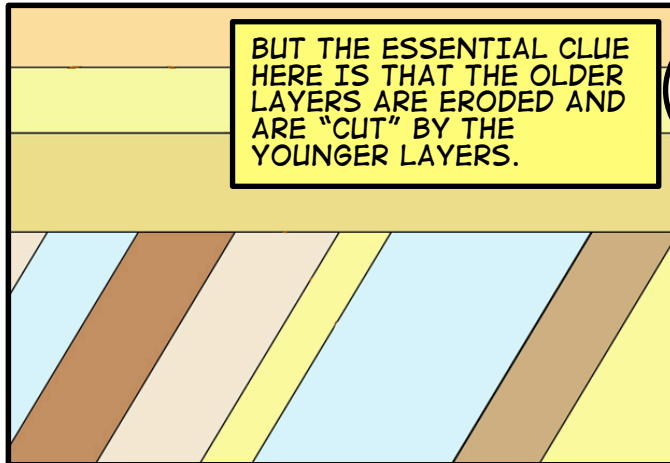


WHEN THE FOLD WAS ERODED IT PRODUCED A SURFACE, THAT MAY HAVE BEEN SUBMERGED



AND HORIZONTAL LAYERS WERE DEPOSITED IN THIS ENVIRONMENT.

THIS INTERPRETATION IMPLIES A HISTORY, AND WE CAN CONCLUDE THAT THE DIPPING LAYERS MUST BE OLDER THAN THE HORIZONTAL LAYERS - WHICH ARE ON TOP ANYWAY!



BUT THE ESSENTIAL CLUE HERE IS THAT THE OLDER LAYERS ARE ERODED AND ARE "CUT" BY THE YOUNGER LAYERS.

SO OUR PRINCIPLE BECOMES "YOUNGER CUTS OLDER".

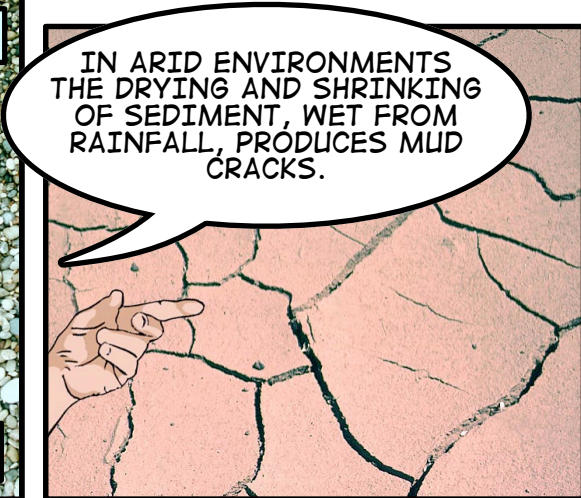


IT TURNS OUT THAT SEDIMENTARY ROCKS OFTEN PROVIDE OTHER CLUES ABOUT WHICH WAY UP THEY ARE. THESE CLUES ARE RELATED TO INTERNAL ROCK STRUCTURES THAT FORM WHEN THE MATERIAL IS DEPOSITED.

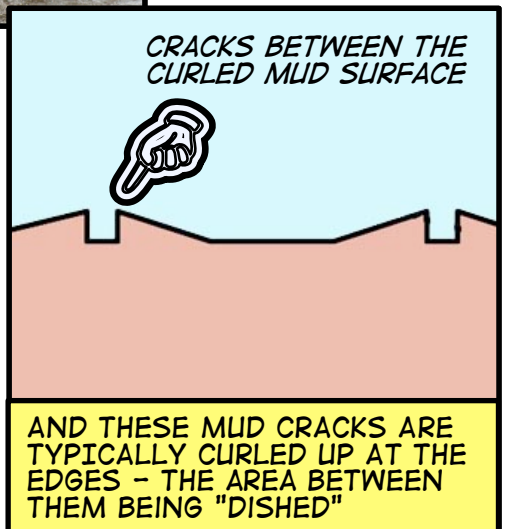


FOR EXAMPLE, DEBRIS ACCUMULATING IN A RIVER BED WILL BE LARGE IN SIZE WHEN THE RIVER IS FLOWING QUICKLY, LIKE THIS ONE, AND SMALLER IN SIZE WHEN IT FLOWS SLOWLY,

AND SINCE RIVER FLOW OFTEN SLOWS UP DURING THE YEAR, THE SEDIMENT MAY RANGE FROM COARSE AT THE BOTTOM OF A UNIT, TO FINE AT ITS TOP, AS THE UNIT ACCUMULATES. THIS EFFECT IS TERMED "GRADED BEDDING."

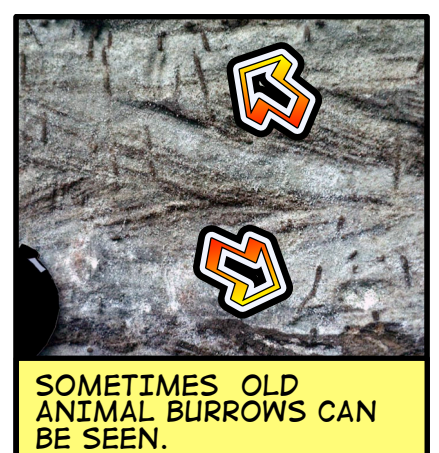
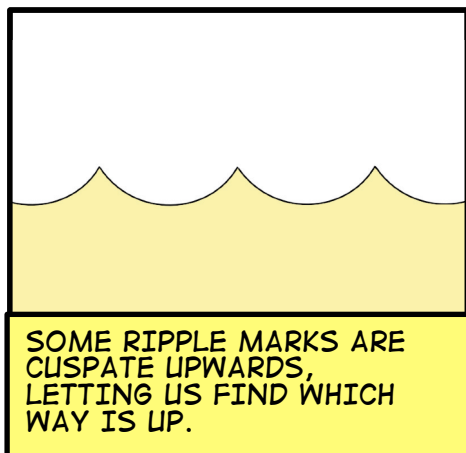
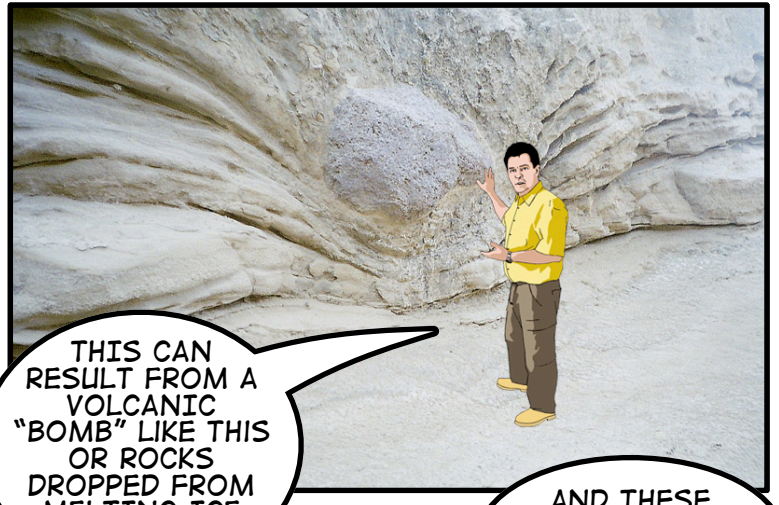
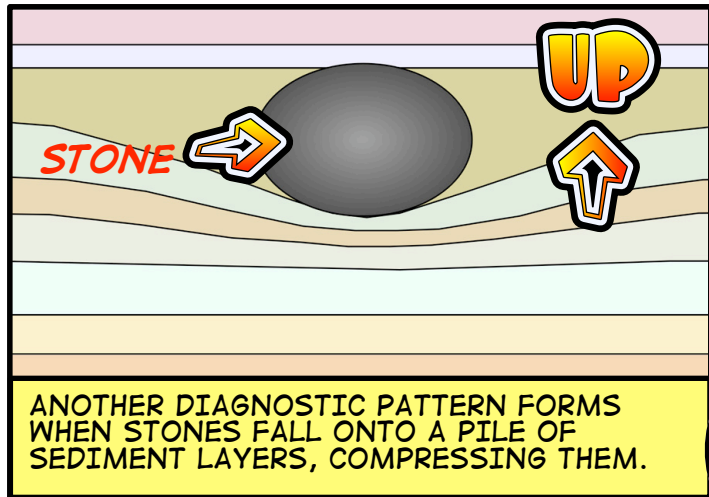
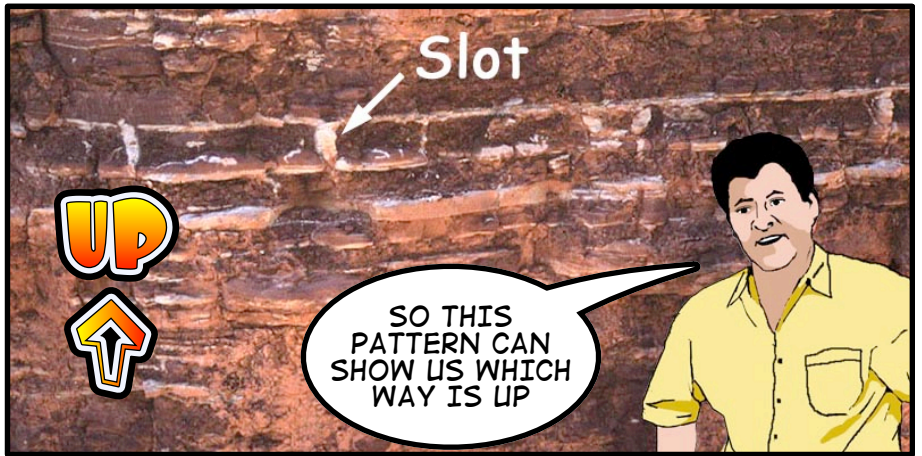
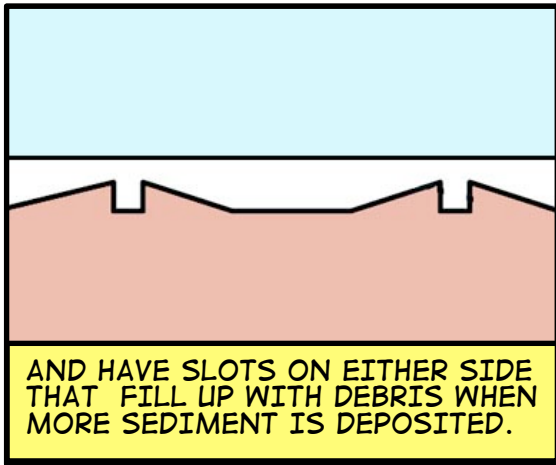


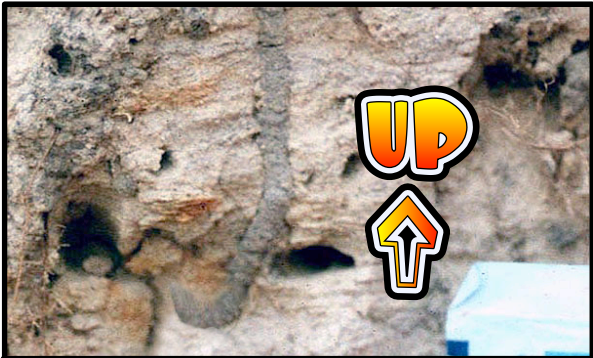
IN ARID ENVIRONMENTS THE DRYING AND SHRINKING OF SEDIMENT, WET FROM RAINFALL, PRODUCES MUD CRACKS.



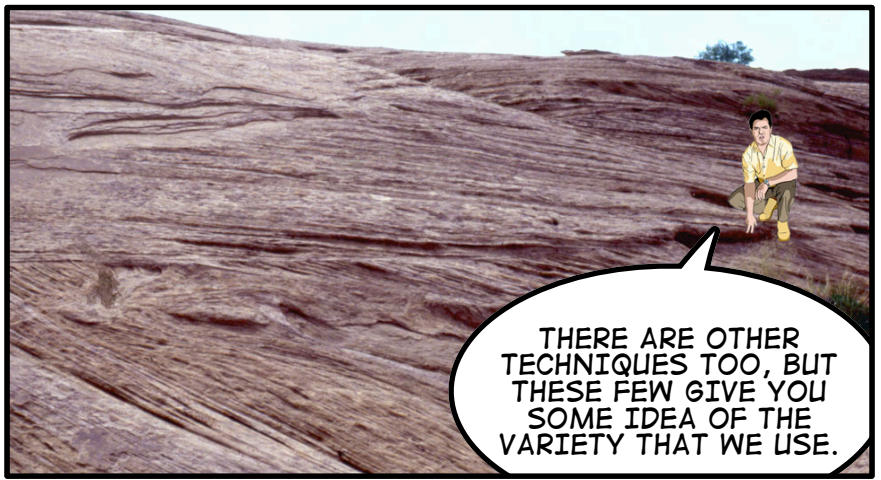
CRACKS BETWEEN THE CURLED MUD SURFACE

AND THESE MUD CRACKS ARE TYPICALLY CURLED UP AT THE EDGES - THE AREA BETWEEN THEM BEING "DISHED"





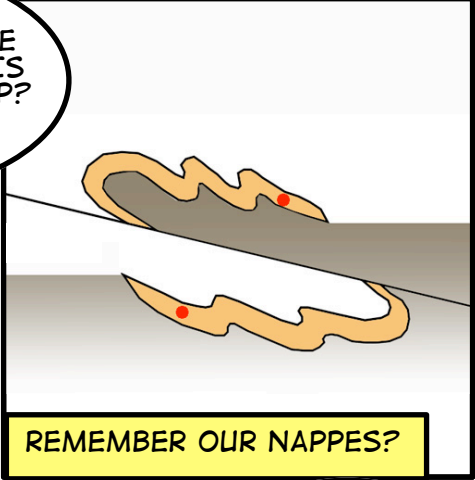
AND WHEN THE BURROW ANGLES ROUND, WE CAN DEDUCE WHICH END IS WHICH, AND FIND OUT WAY UP.



THERE ARE OTHER TECHNIQUES TOO, BUT THESE FEW GIVE YOU SOME IDEA OF THE VARIETY THAT WE USE.

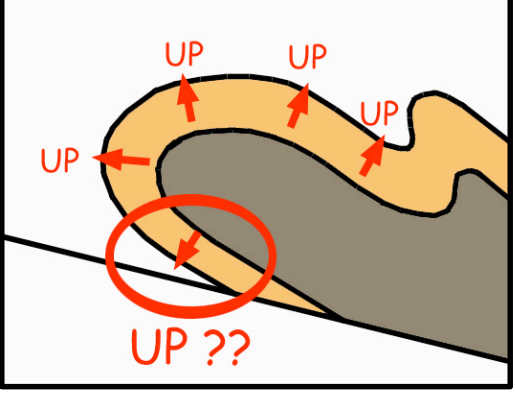


BUT WHY DO WE CARE? SURELY THE YOUNGEST LAYER IS ALWAYS AT THE TOP? WELL, NOT NECESSARILY.

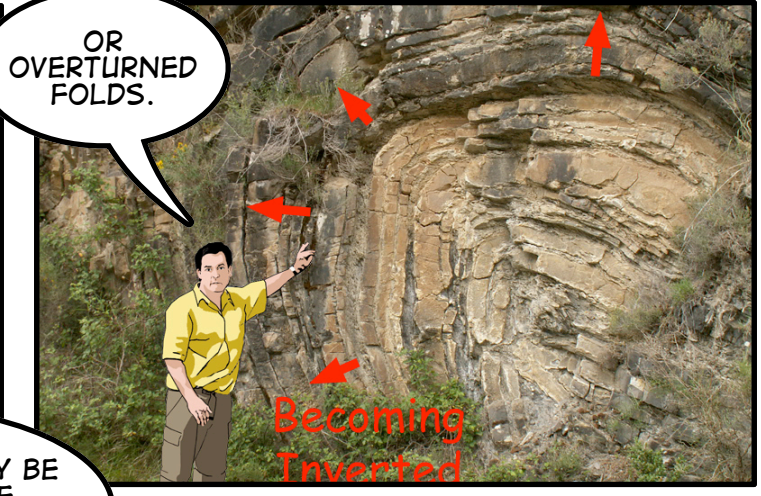


REMEMBER OUR NAPPES?

ONE PART OF THE FOLD HAS LAYERS THAT'RE UPSIDE DOWN!



THIS IS TRUE WHENEVER WE HAVE RECUMBENT

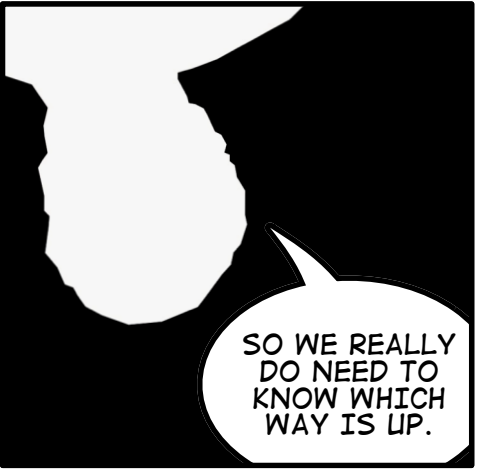


OR OVERTURNED FOLDS.

THEN WE MAY ONLY BE ABLE TO SEE THE INVERTED LAYERS IN A PARTICULAR OUTCROP.



AND IF THE FOLD IS ENORMOUS,



SO WE REALLY DO NEED TO KNOW WHICH WAY IS UP.