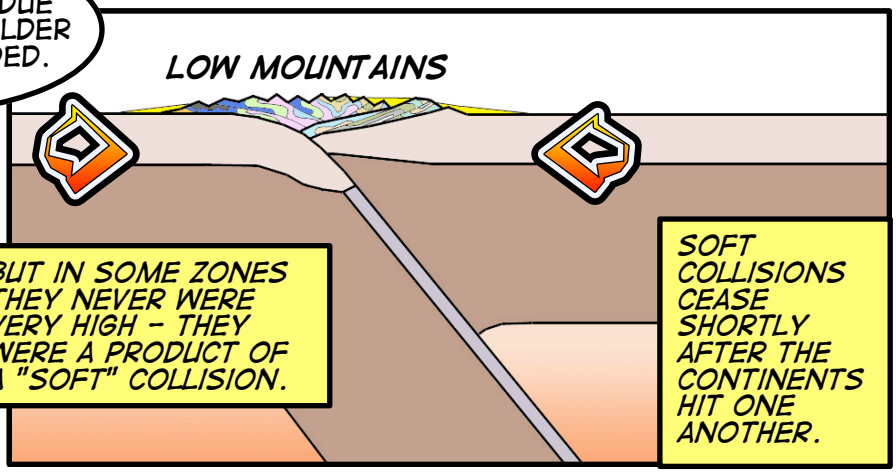
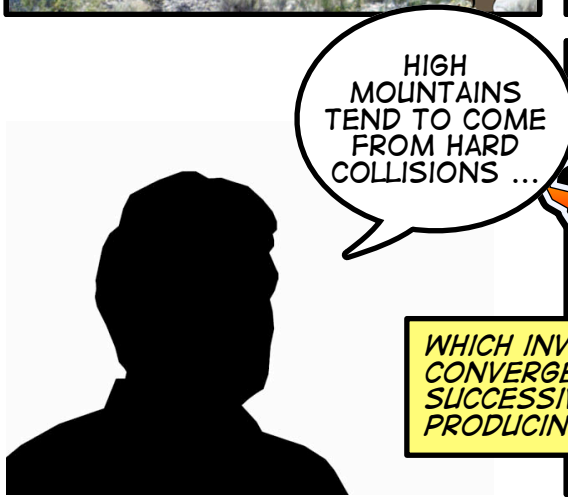
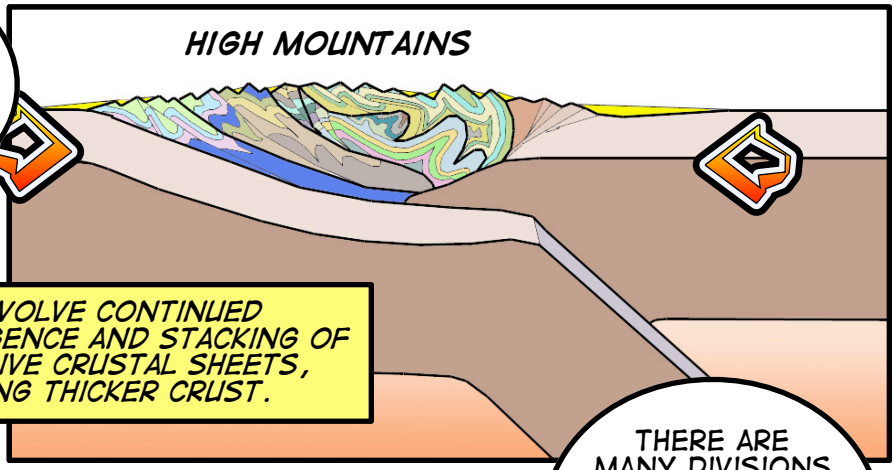

PART 10
THE ALPS

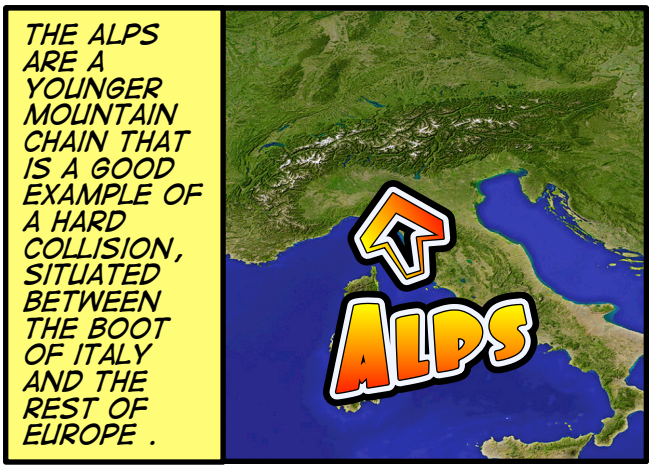

THE APPALACHIANS ARE NOT A PARTICULARLY HIGH SET OF MOUNTIANS.


PARTLY, THIS IS DUE TO THEIR BEING OLDER AND MORE ERODED.

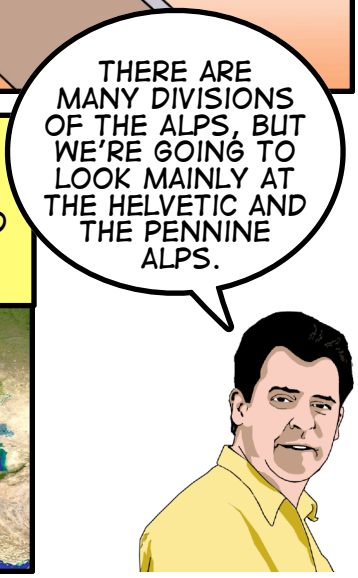

LOW MOUNTAINS
BUT IN SOME ZONES THEY NEVER WERE VERY HIGH - THEY WERE A PRODUCT OF A "SOFT" COLLISION.
SOFT COLLISIONS CEASE SHORTLY AFTER THE CONTINENTS HIT ONE ANOTHER.

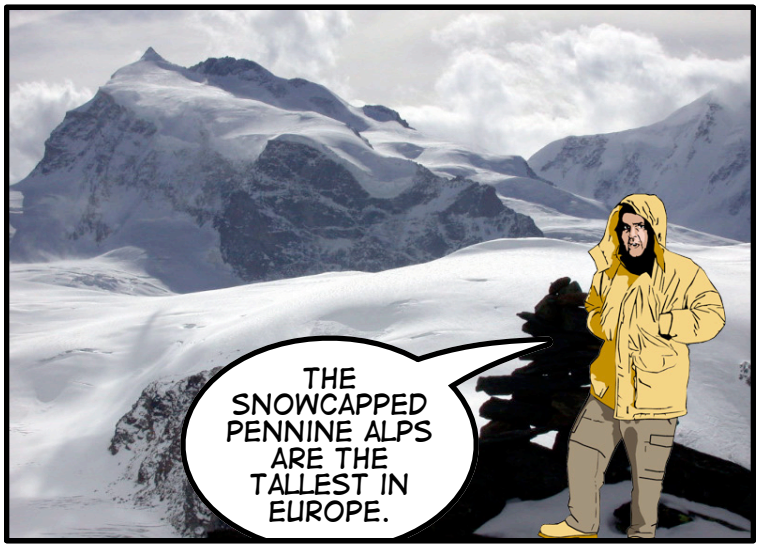

HIGH MOUNTAINS TEND TO COME FROM HARD COLLISIONS ...

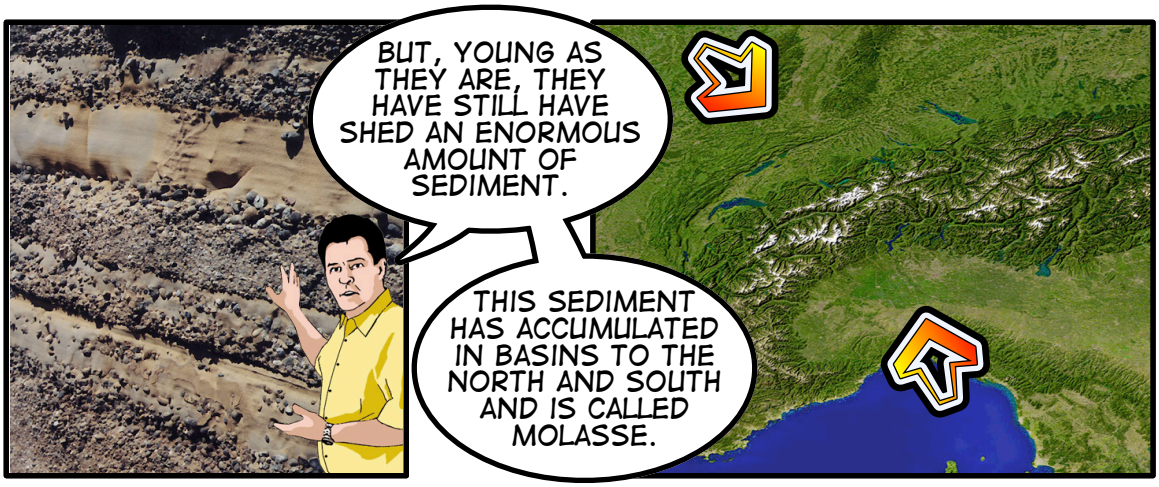

HIGH MOUNTAINS
WHICH INVOLVE CONTINUED CONVERGENCE AND STACKING OF SUCCESSIVE CRUSTAL SHEETS, PRODUCING THICKER CRUST.


THE ALPS ARE A YOUNGER MOUNTAIN CHAIN THAT IS A GOOD EXAMPLE OF A HARD COLLISION, SITUATED BETWEEN THE BOOT OF ITALY AND THE REST OF EUROPE .
ALPS

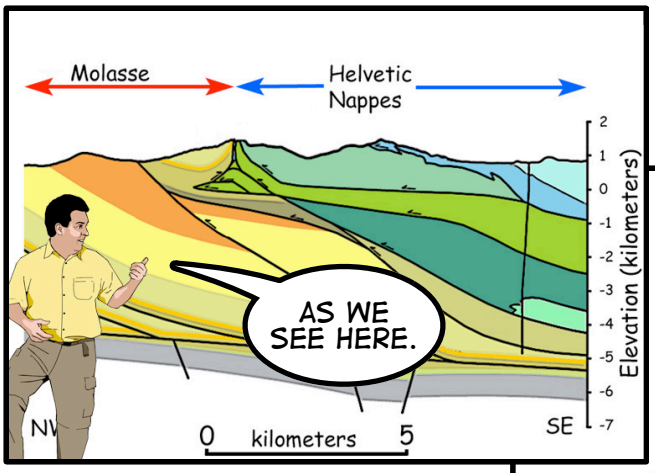

THEY COVER PARTS OF SWITZERLAND, FRANCE, ITALY AND AUSTRIA, AND CONTINUE EASTWARDS INTO THE BALKANS, AND THEN THE MIDDLE EAST.


THERE ARE MANY DIVISIONS OF THE ALPS, BUT WE'RE GOING TO LOOK MAINLY AT THE HELVETIC AND THE PENNINE ALPS.



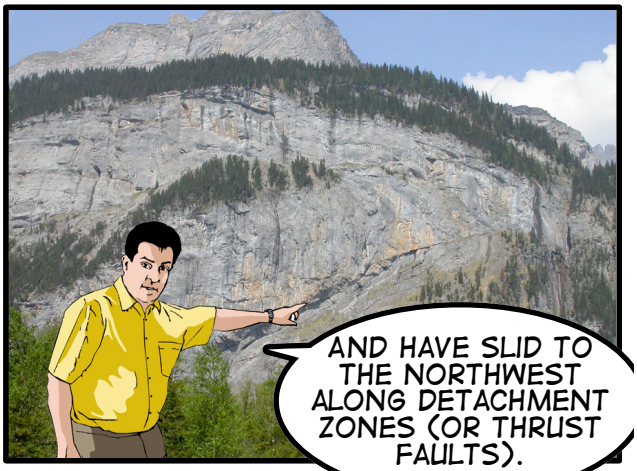


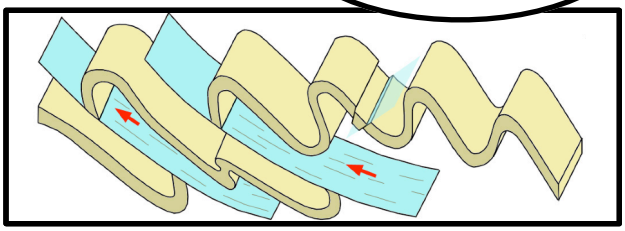
SOMETIMES THE OLDEST MOLASSE IS ACTUALLY CAUGHT UP IN THE FOLDING OF THE MOUNTAINS AS IT WAS DEPOSITED AT THE SAME TIME AS THE DEFORMATION STARTED.



THE DEFORMATION IS A RESULT OF THE COLLISION OF AFRICA WITH EUROPE THAT STARTED ABOUT 100 MA AGO AND CONTINUES TO THE PRESENT DAY.

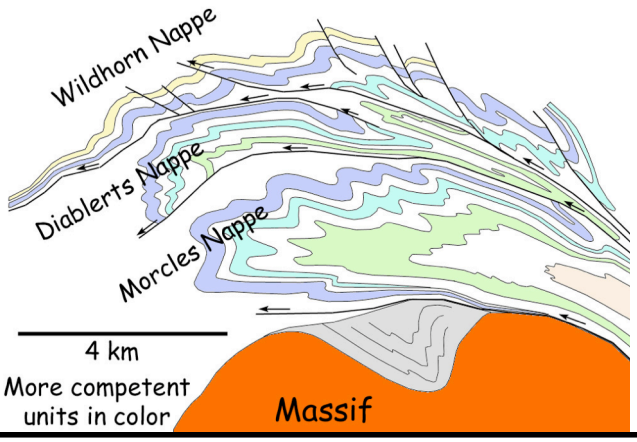
THE MOLASSES SITS ON THE HELVETIC ALPS WHICH ARE MADE OF RELATIVELY UNMETAMORPHOSED ROCKS. THESE UNITS HAVE SLID OFF BASEMENT ROCKS (CALLED MASSIFS) AND HAVE BEEN TRANSPORTED TO THE NORTH-EAST BY THRUSTING. THE THRUST SHEETS ARE STACKED UP ON TOP OF ONE ANOTHER, AND CONTAIN ...

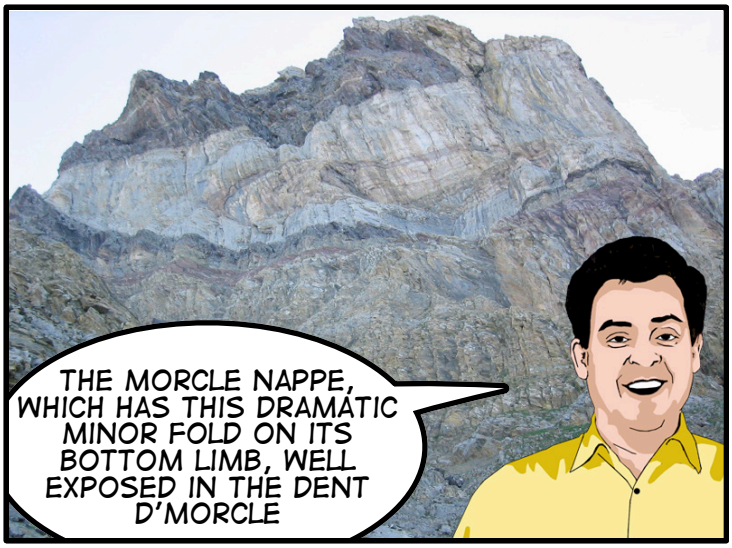




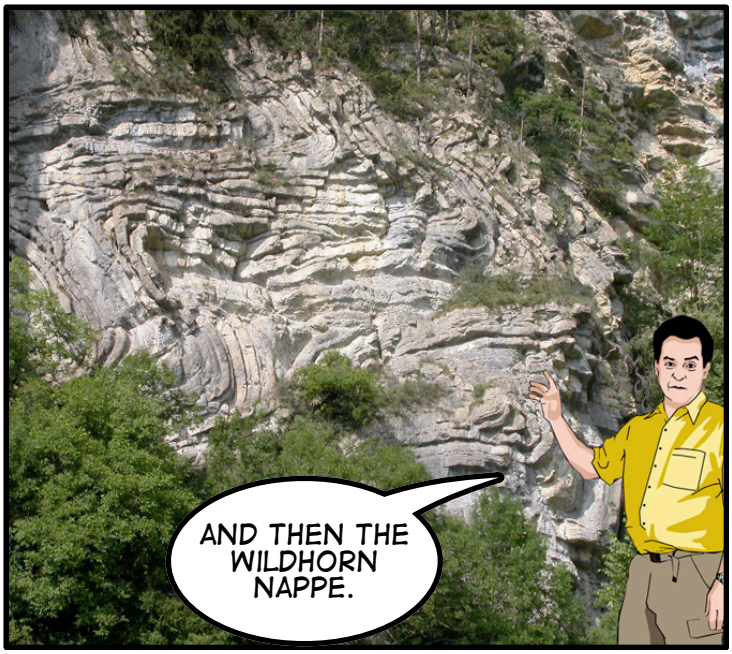
WELL, ACTUALLY THE FOLDS ARE NOT ALWAYS RECUMBENT, AND ONCE AND AGAIN THIS SLIDING IS HELPED BY INCOMPETENT EVAPORATES.

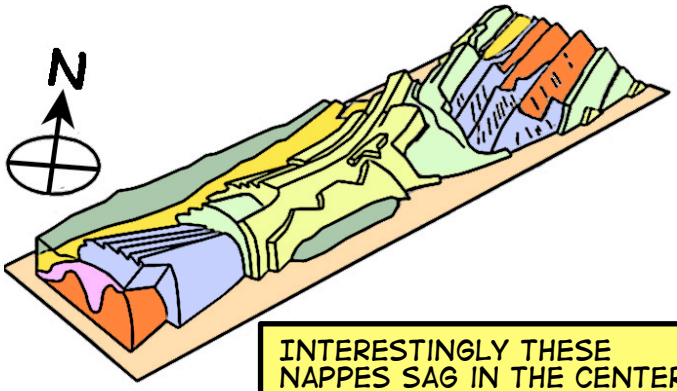
THE HELVETIC ALPS HAVE 3 MAIN NAPPES.



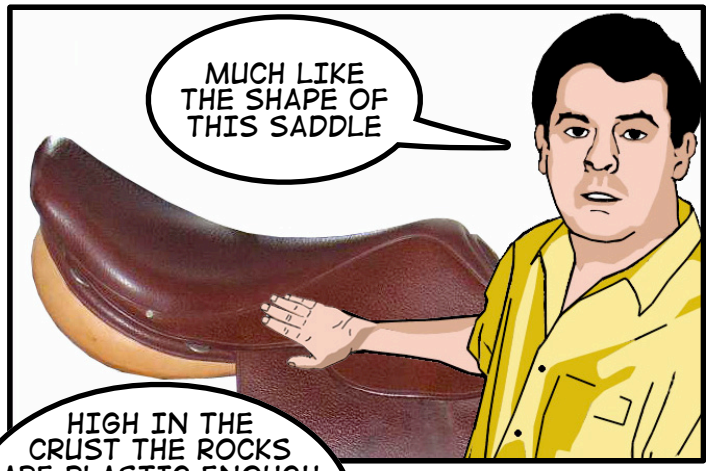


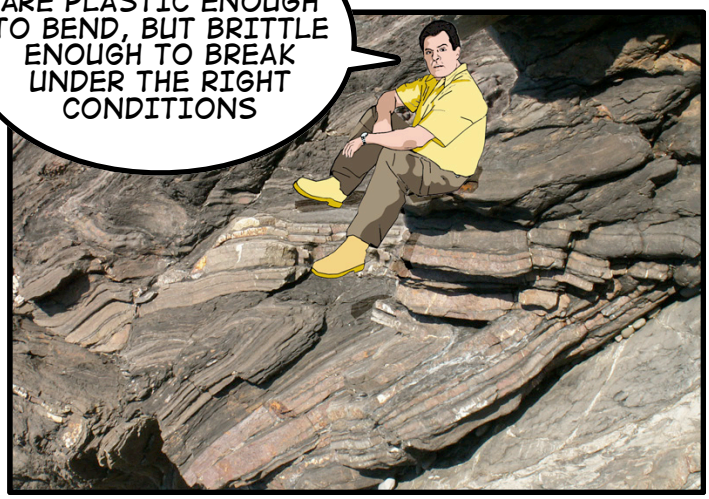
THRUST OVER THAT IS THE DIABLERT NAPPE,

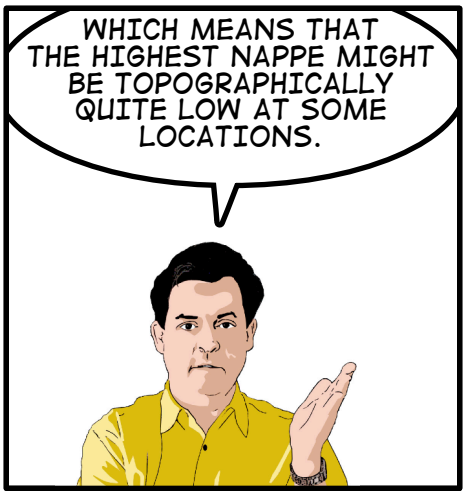




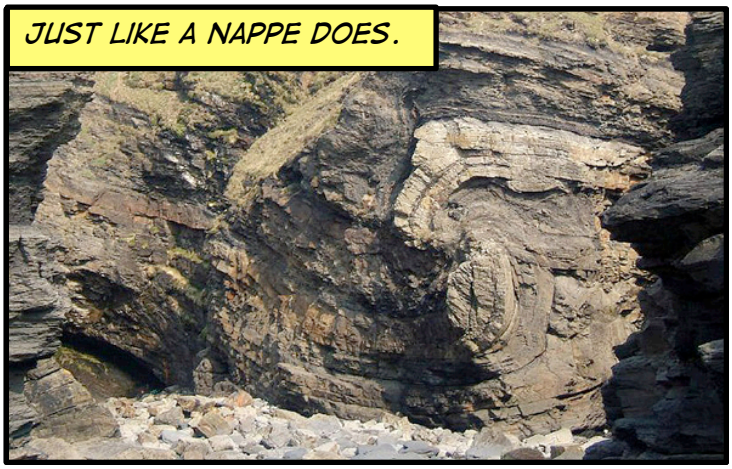
INTERESTINGLY THESE NAPPES SAG IN THE CENTER, PRODUCING AN EFFECT

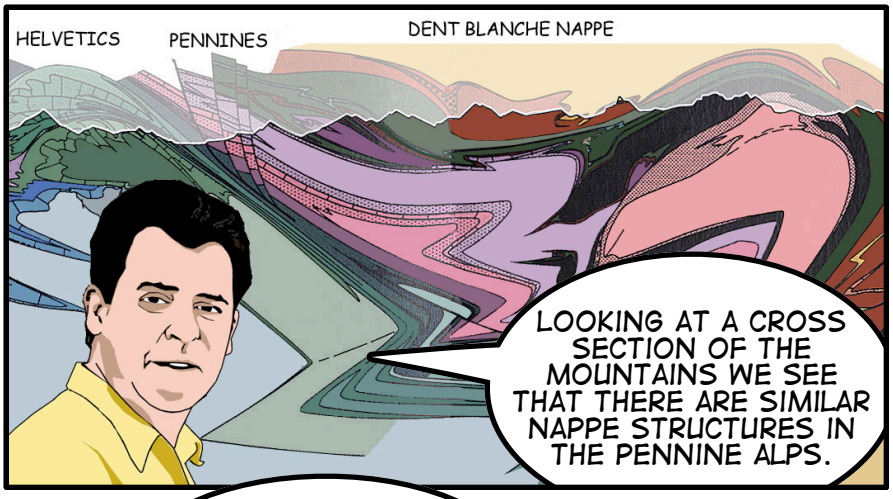


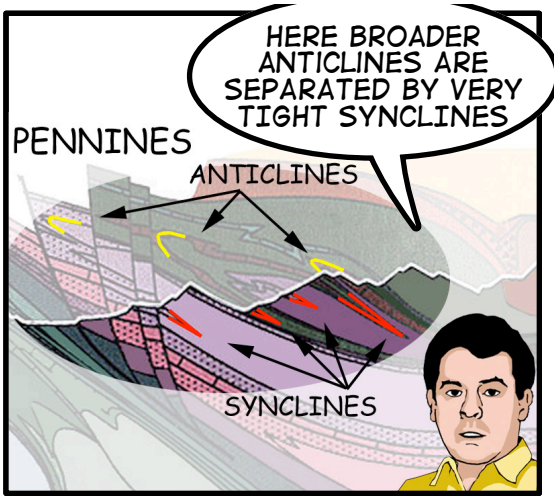


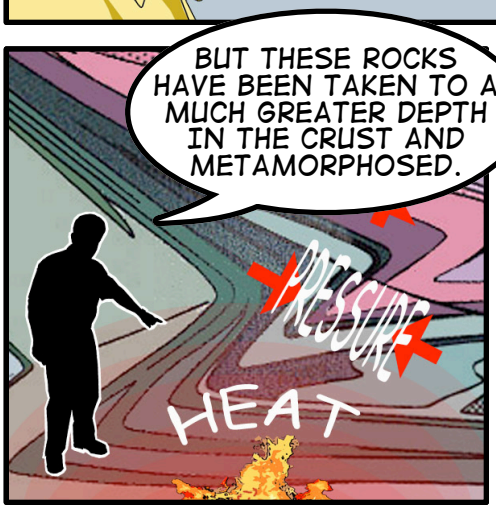


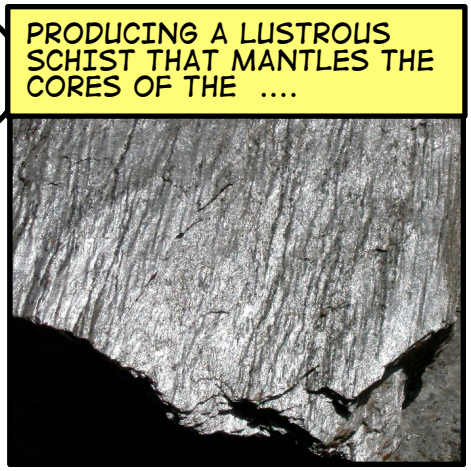
AGAIN, THIS STYLE OF FOLDING IS TYPICAL OF FORMATION HIGH IN THE CRUST, AND THE FACT THAT THE ROCKS HAVE SUFFERED VERY LITTLE META-MORPHISM SUPPORTS THIS IDEA.

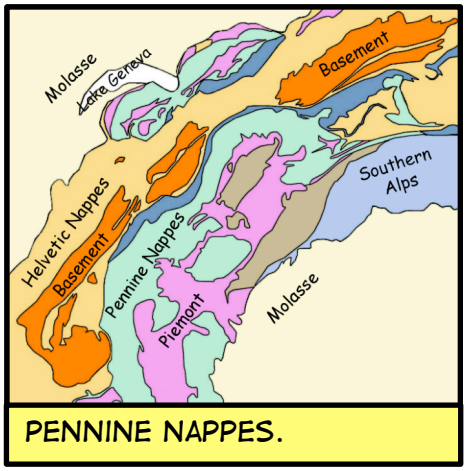


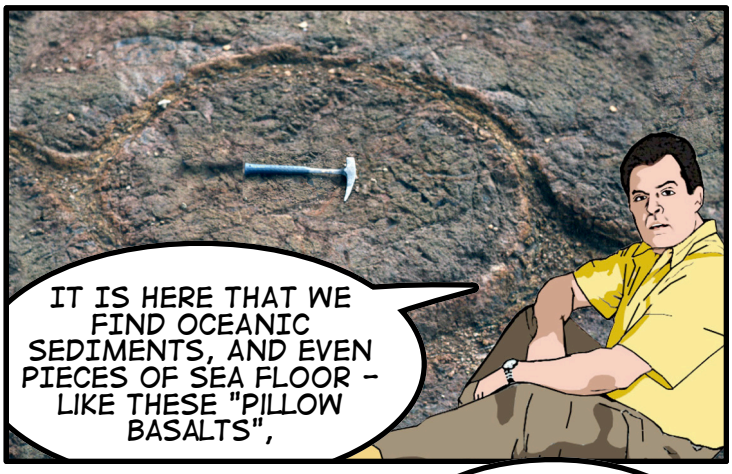

HELVETICS
PENNINES
DENT BLANCHE NAPPE
LOOKING AT A CROSS SECTION OF THE MOUNTAINS WE SEE THAT THERE ARE SIMILAR NAPPE STRUCTURES IN THE PENNINE ALPS.


HERE BROADER ANTICLINES ARE SEPARATED BY VERY TIGHT SYNCLINES
PENNINES
ANTICLINES
SYNCLINES

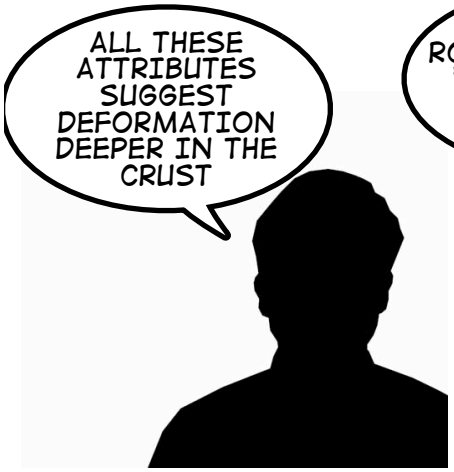

BUT THESE ROCKS HAVE BEEN TAKEN TO A MUCH GREATER DEPTH IN THE CRUST AND METAMORPHOSED.
PRESSURE
HEAT

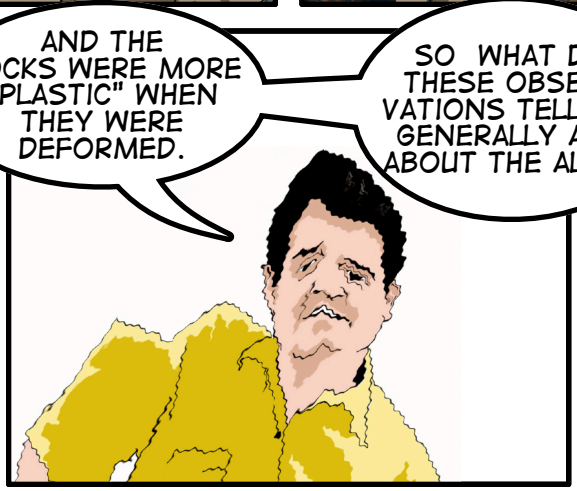

PRODUCING A LUSTROUS SCHIST THAT MANTLES THE CORES OF THE ....

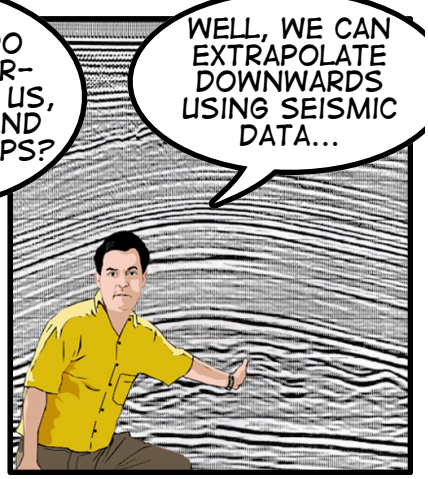

Molasse
Lake Geneva
Basement
Southern Alps
Helvetic Nappes
Basement
Pennine Nappes
Piemont
Molasse
PENNINE NAPPES.

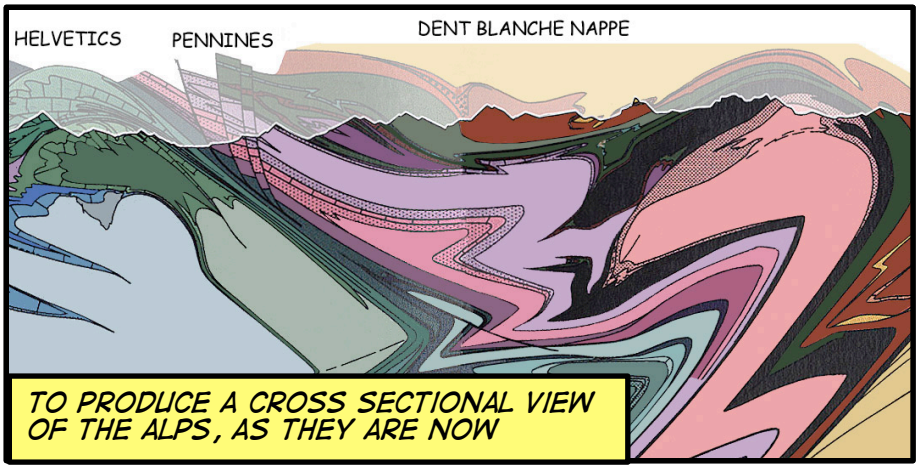

IT IS HERE THAT WE FIND OCEANIC SEDIMENTS, AND EVEN PIECES OF SEA FLOOR - LIKE THESE "PILLOW BASALTS",


SUCH AS THOSE EXPOSED AT THE BASE OF THE MATTERHORN, HIGH IN THE PENNINES.


ALL THESE ATTRIBUTES SUGGEST DEFORMATION DEEPER IN THE CRUST

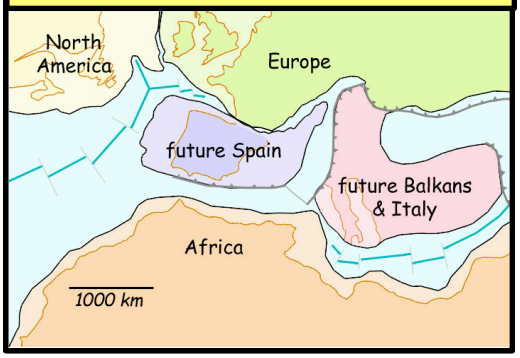

AND THE ROCKS WERE MORE "PLASTIC" WHEN THEY WERE DEFORMED.
SO WHAT DO THESE OBSER-VATIONS TELL US, GENERALLY AND ABOUT THE ALPS?


WELL, WE CAN EXTRAPOLATE DOWNWARDS USING SEISMIC DATA...

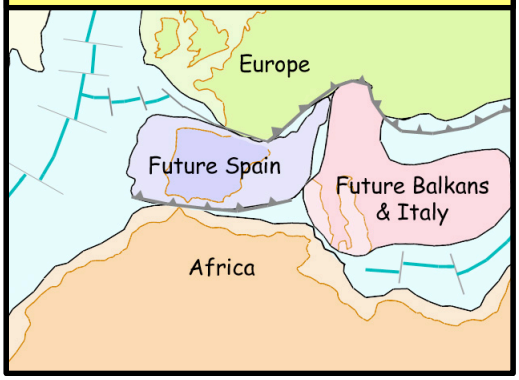


TO PRODUCE A CROSS SECTIONAL VIEW OF THE ALPS, AS THEY ARE NOW

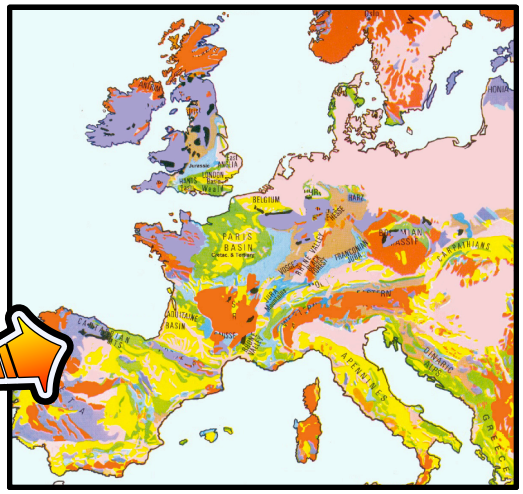
AND TO SOME EXTENT, WORK BACK IN TIME (TO ~100 MY AGO IN THIS DIAGRAM).



AND THEN FORWARD TO UNDERSTAND HOW THE ALPS DEVELOPED (TO ~ 50 MY AGO).



AND HOW THEY FIT WITH THE GEOGRAPHY AND THE GEOLOGY OF THE REST OF EUROPE, AND THUS WHY THE TOPOGRAPHY IS AS IT IS.



WHY PARIS HAS NO EARTHQUAKES,

WHERE WE MIGHT FIND COAL,