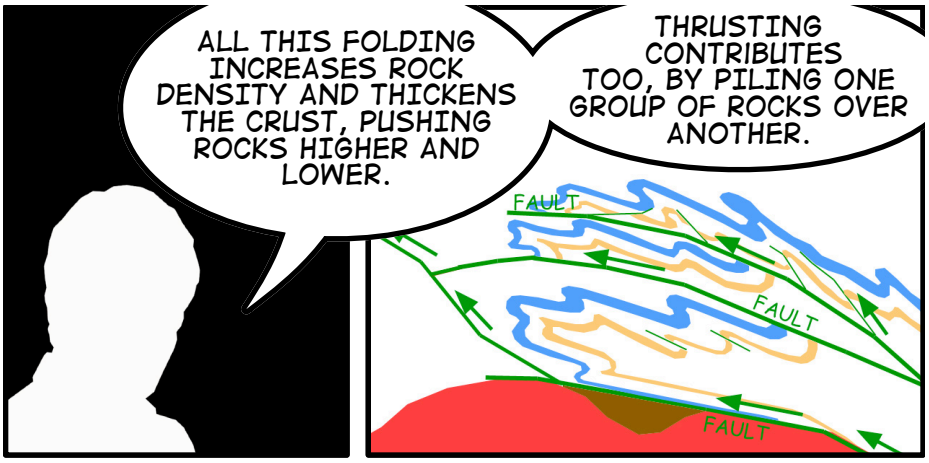
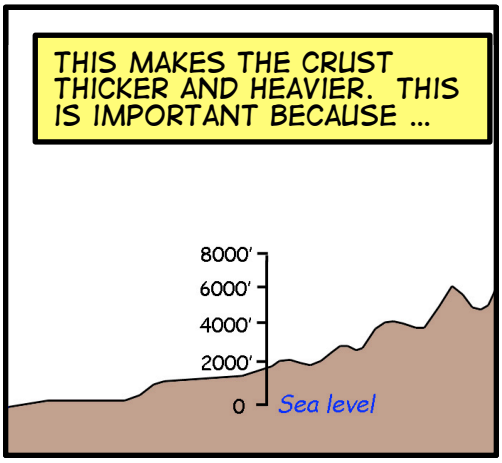
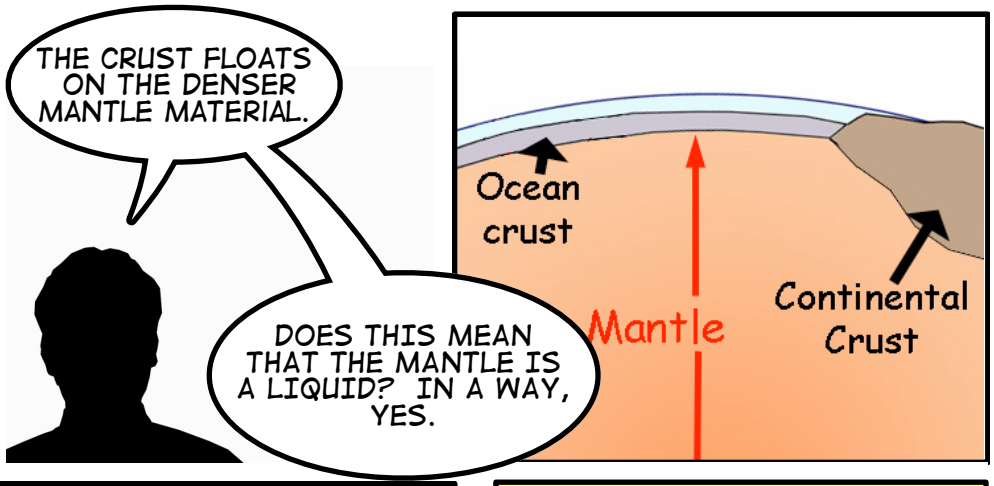
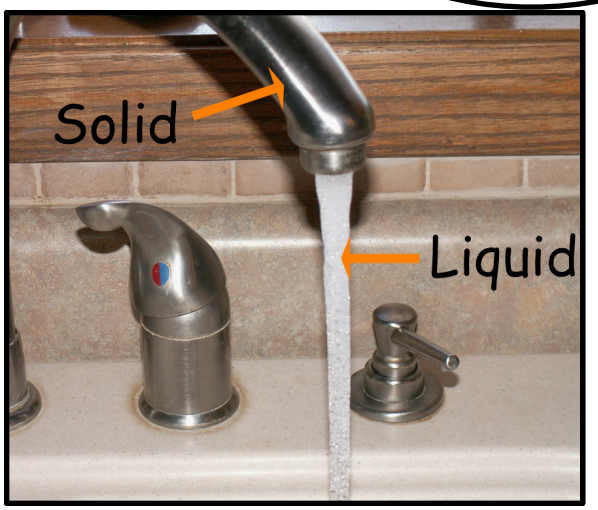




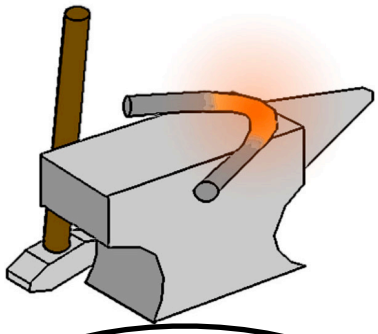


TRADITIONAL EXPLANATIONS OF SOLIDS AND LIQUIDS STRESS HOW SOLIDS KEEP THEIR SHAPE.

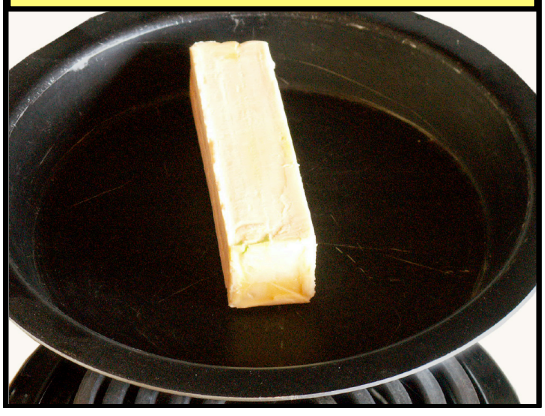
THEY DO NOT MENTION TIME, OR OTHER FACTORS SUCH AS TEMPERATURE OR PRESSURE.



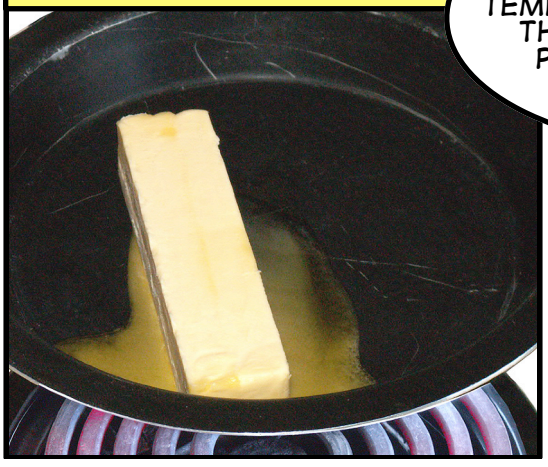
WE ALL KNOW THAT HEATING A SUBSTANCE MAKES IT EASIER TO BEND.



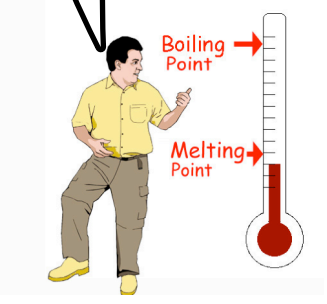
IF WE HEAT IT UP ENOUGH, IT WILL USUALLY TURN INTO A LIQUID,

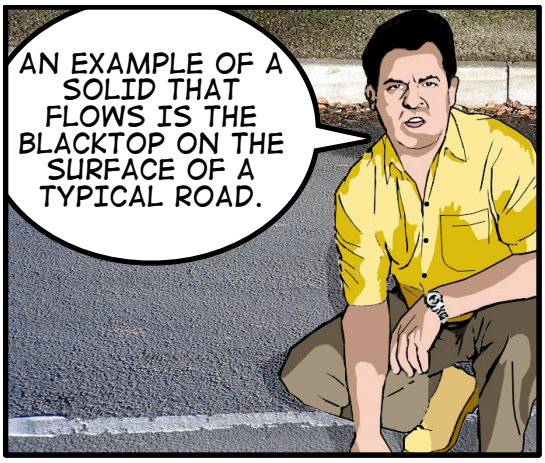


LIKE THIS STICK OF BUTTER.



BUT MANY "SOLID" SUBSTANCES WILL FLOW AT TEMPERATURES WELL BELOW THEIR MELTING POINT, PARTICULARLY GIVEN ENOUGH TIME.

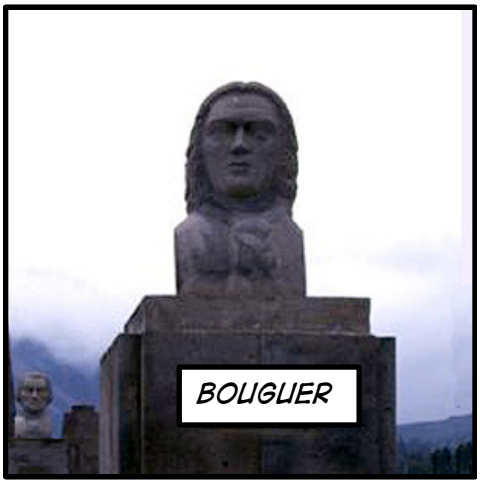


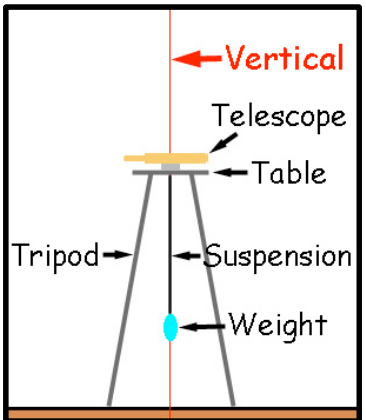


LEAVE A HEAVY ITEM ON THE ROAD AND IT WILL START TO SINK IN, LEAVING A DEPRESSION WHEN YOU REMOVE IT.

ANOTHER EXAMPLE OF A SOLID FLOWING IS A GLACIER.

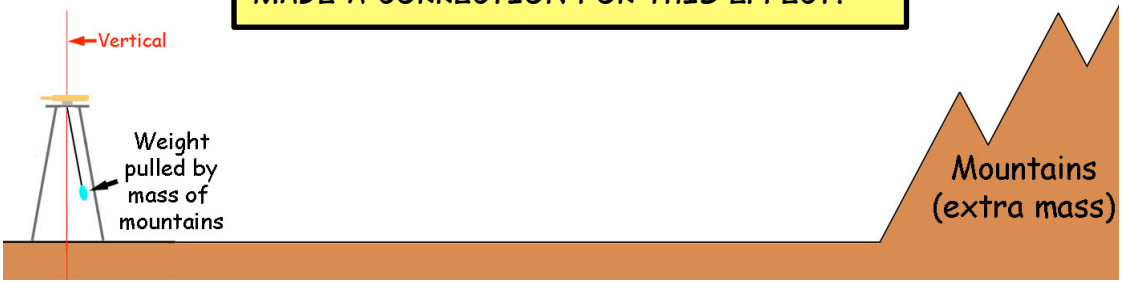
GEOLOGISTS THINK THAT THE EARTH'S MANTLE ACTS JUST LIKE THIS AND, GIVEN LONG ENOUGH, IT WILL FLOW. THIS WAS FIRST SUGGESTED WHEN WE WERE TRYING TO EXPLAIN A RATHER UNUSUAL OBSERVATION MADE BY A GUY CALLED BOUGUER WHEN HE WAS MAPPING NEAR THE ANDES IN EQUADOR.

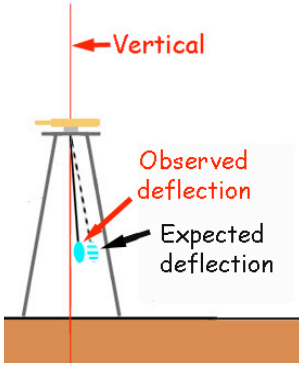




MAPPING TELESCOPE ORIENTED USING A PLUM BOB.

PLUM BOBS ARE USED TO FIND VERTICAL- A WAY TO MAKE SURE YOUR INSTRUMENT IS HORIZONTAL. BOUGUER WAS AWARE THAT THE EXTRA MASS OF THE ANDES WOULD ATTRACT THE WEIGHT AND SO HE MADE A CORRECTION FOR THIS EFFECT.

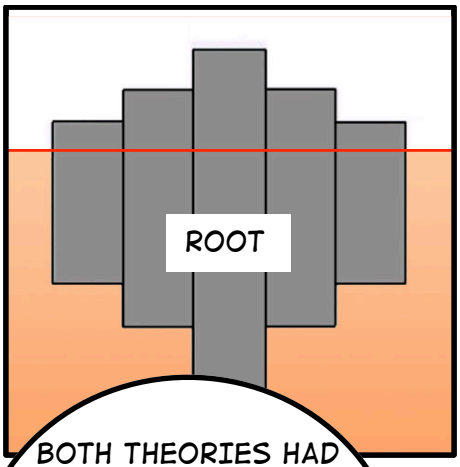




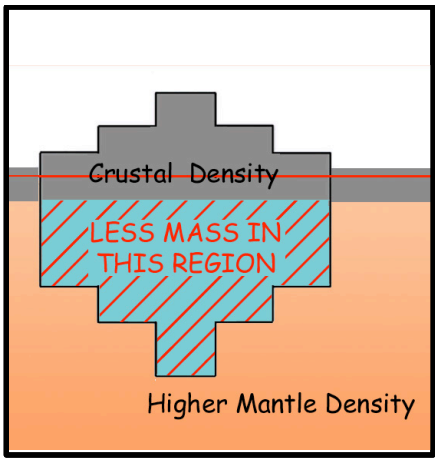
BUT HIS CORRECTION WAS TOO BIG! THIS IMPLIED THAT THERE WAS LESS MASS IN THE MOUNTIANS THAN HE HAD CALCULATED.

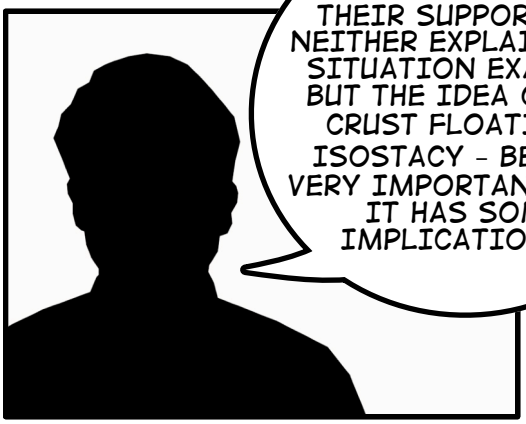
ONE POSSIBLE SOLUTION TO THIS PROBLEM MIGHT BE THAT THE MOUNTAINS WERE MADE UP OF LOWER DENSITY ROCK, SO THERE WAS LESS TOTAL MASS THAN BOUGUER HAD ESTIMATED.
BUT HANG ON, DOESN'T COMPRESSION INCREASE THE DENSITY?

ANOTHER SOLUTION WOULD BE TO ASSUME THAT THE CRUST FLOATS ON THE MANTLE. THE TALLER THE MOUNTAIN THE DEEPER THE "ROOT" OF CRUSTAL ROCK BENEATH IT.

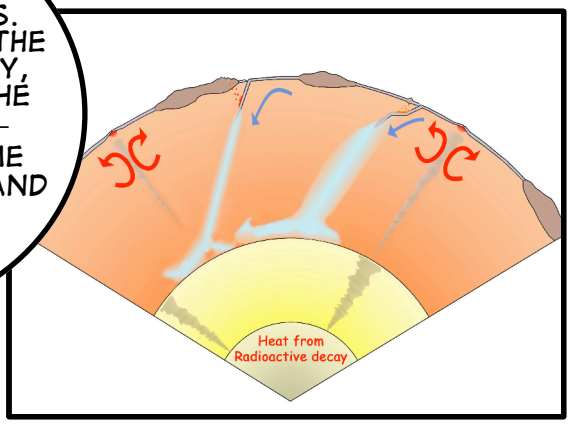


THIS ROOT OF CRUSTAL ROCK, ALTHOUGH QUITE DENSE, IS LESS DENSE THAN MANTLE ROCK THAT IT DISPLACES. SO THE NET EFFECT, IS THAT THERE IS LESS MASS BECAUSE OF THE LOWER DENSITY ROOT – WOW!



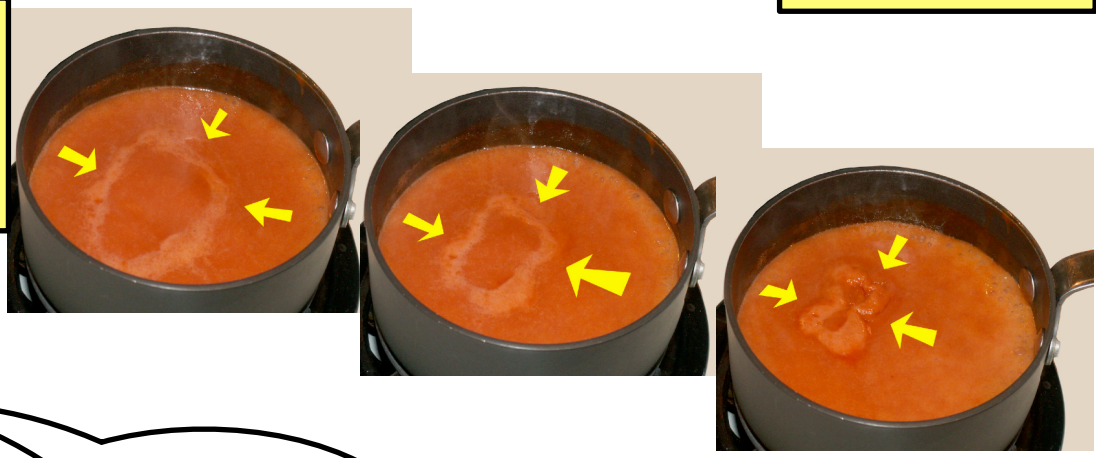


BOTH THEORIES HAD THEIR SUPPORTERS. NEITHER EXPLAINS THE SITUATION EXACTLY, BUT THE IDEA OF THE CRUST FLOATING – ISOSTACY – BECAME VERY IMPORTANT. AND IT HAS SOME IMPLICATIONS .

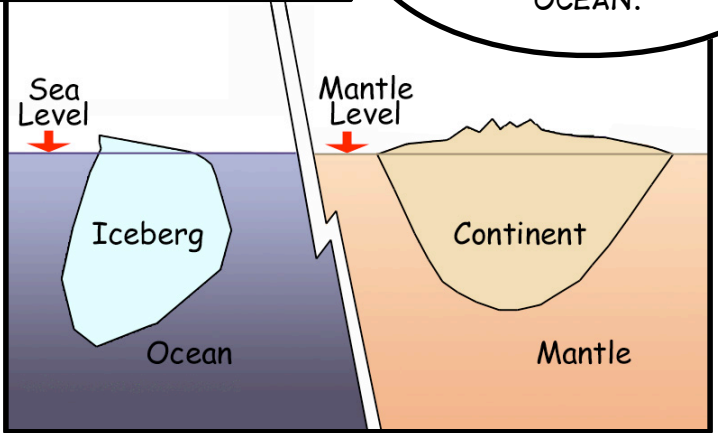


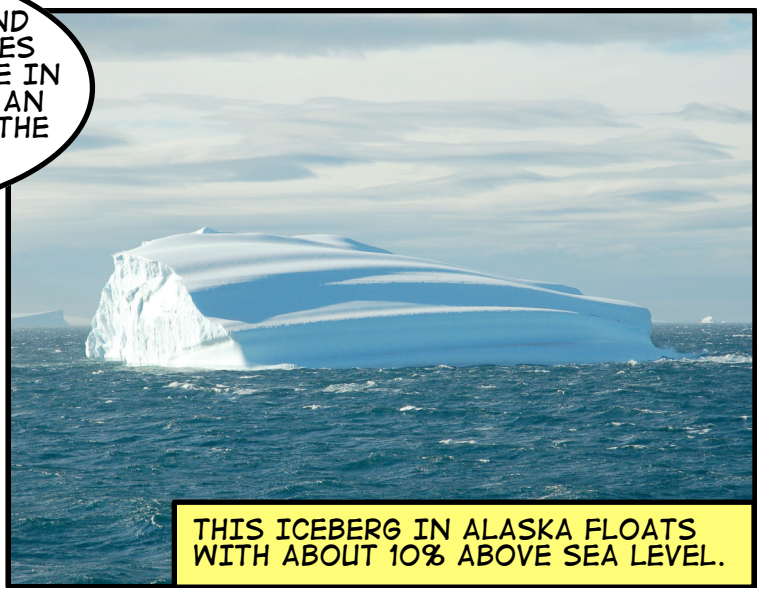
OVER VAST PERIODS OF TIME, THE MANTLE HAS ESTABLISHED A CONVECTION PATTERN THAT DRIVES PLATE TECTONICS AND CONTROLS SEA FLOOR SPREADING AND SUBDUCTION.

CONVECTION IS A METHOD BY WHICH HEAT IS TRANSFERRED THROUGH A FLUID – LIKE THIS PAN OF TOMATO SOUP ON THE STOVE. SOLIDS DON'T CONVECT.

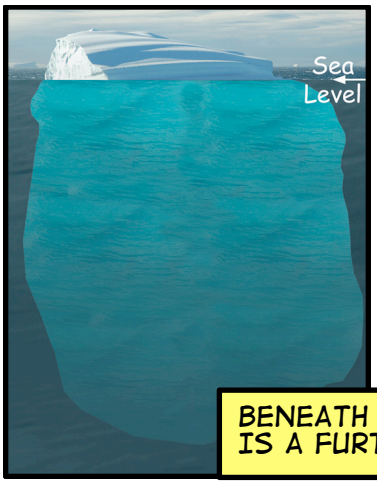


WE NOW UNDERSTAND THAT THE CRUST DOES FLOAT ON THE MANTLE IN THE SAME WAY THAT AN ICEBERG FLOATS ON THE OCEAN.

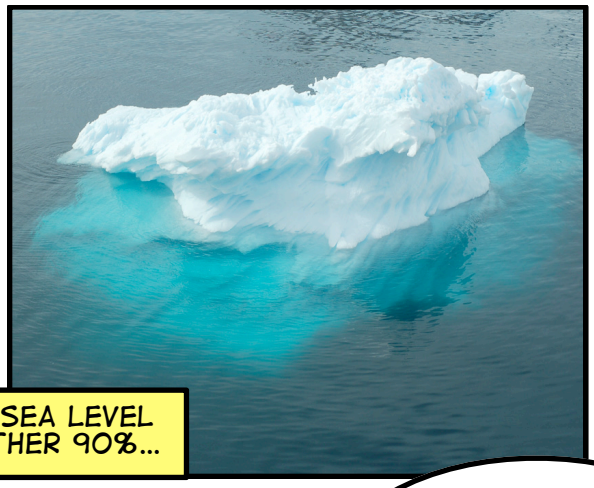


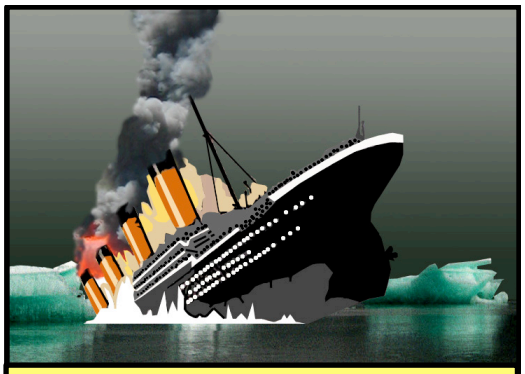


THIS ICEBERG IN ALASKA FLOATS WITH ABOUT 10% ABOVE SEA LEVEL.



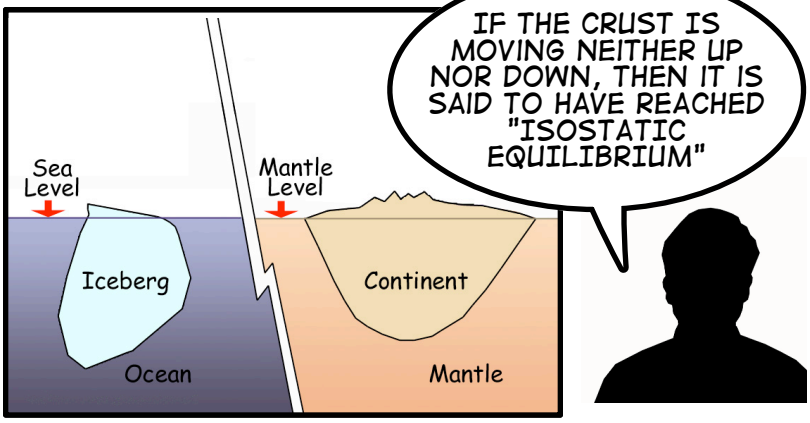
BENEATH SEA LEVEL IS A FURTHER 90%...





WHICH CAN BE BAD NEWS FOR MARINERS - REMEMBER THE TITANIC IN APRIL 1912?

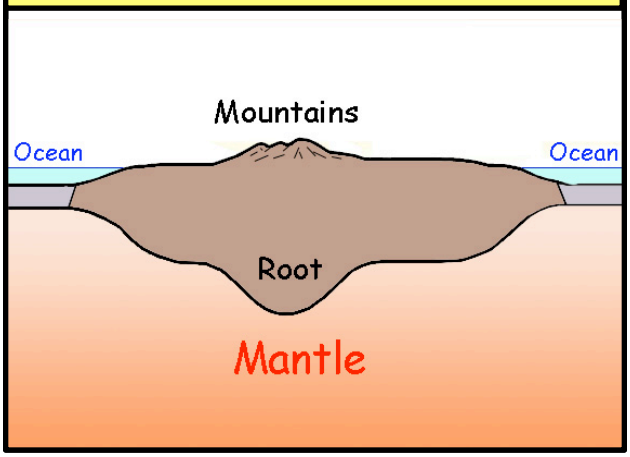
THE CRUST FLOATS IN A SIMILAR WAY, BUT WITH MUCH LESS ABOVE THIS "MANTLE LEVEL" THAN BELOW. SO MOUNTAIN ROOTS ARE THE EQUIVALENT OF THE HIDDEN PART OF AN ICEBERG.



AS MOUNTAIN CHAINS FORM, THEY ARE OFTEN PULLED DOWNWARDS. SO THEY HAVE TO RISE (REBOUND) TO REGAIN ISOSTATIC EQUILIBRIUM - WHICH EXPLAINS WHY YOU HEAR THAT MT. EVEREST IS GETTING HIGHER.

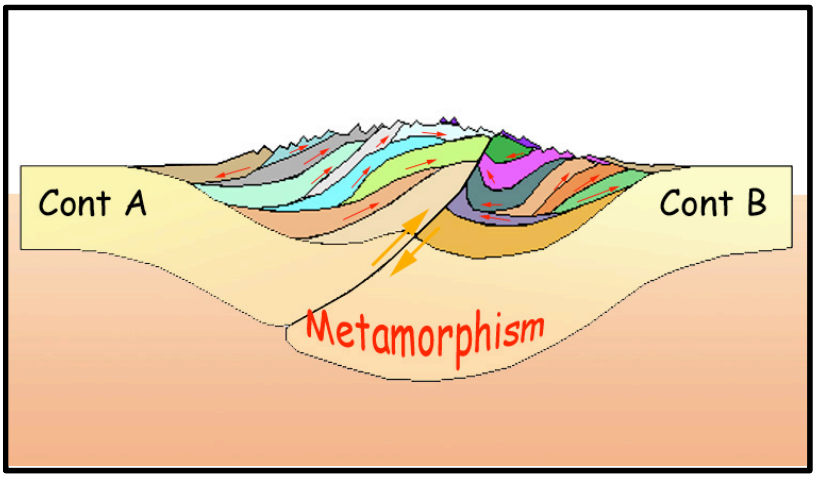
NOTE THE COOL SEDIMENTARY ROCKS!

THE THICKER THE CRUST, THE DEEPER ITS ROOTS AND THE HIGHER THE ELEVATION OF THE LAND.



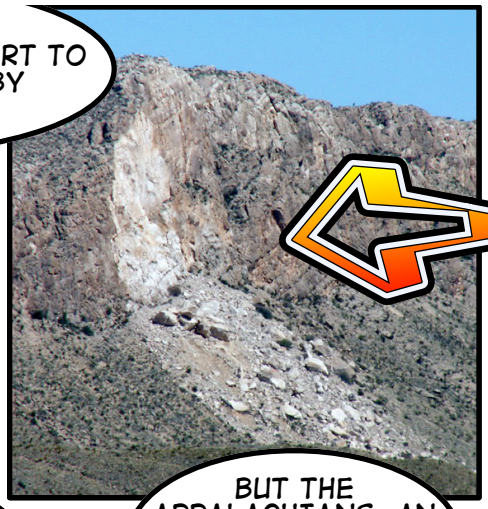
REMEMBER: LIKE ALL FLOATING ITEMS, WHEN MATERIAL IS REMOVED FROM THE TOP - THEN THE ITEM BOBS UP A LITTLE, KEEPING THE SAME PERCENTAGE ABOVE THE FLUID LEVEL. BUT IF THE ITEM IS SMALLER, THE AMOUNT STICKING UP WILL BE LESS!

PHEW!

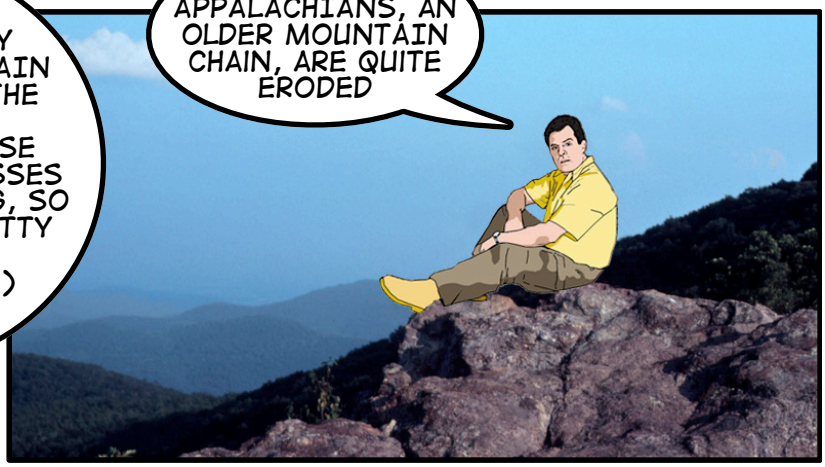


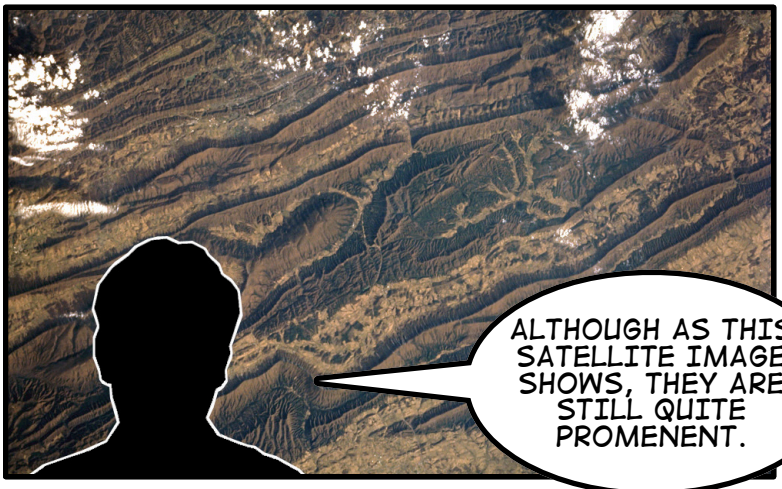
SO WHERE COLLISION, NAPPE FORMATION, THRUSTING AND OTHER PROCESSES INCREASE THE CRUSTAL THICKNESS, THIS PRODUCES HIGHER LAND- WHICH WE CALL MOUNTAINS.

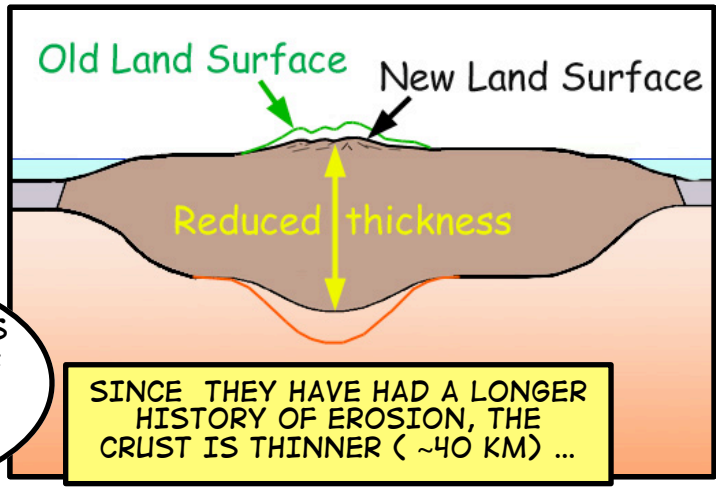
AS THE COLLISION TAKES PLACE, THE THICKENING OF THE CRUST AND ALL ITS CONSEQUENCES TAKE PLACE PROGRESSIVELY AND SLOWLY.

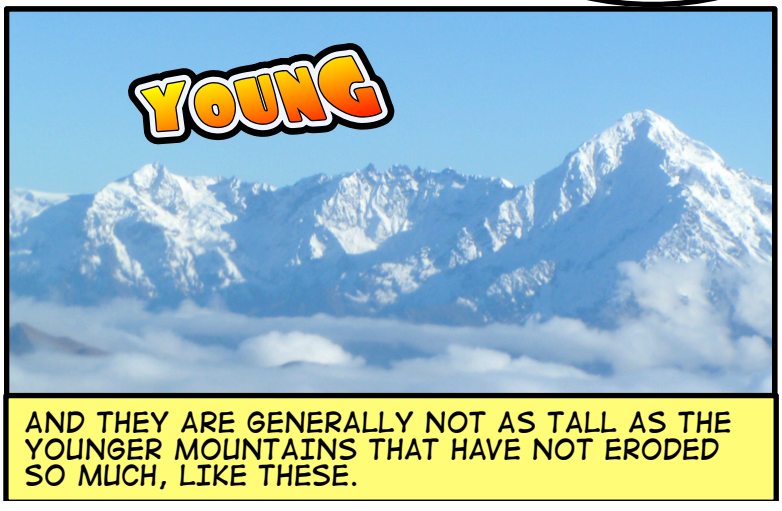


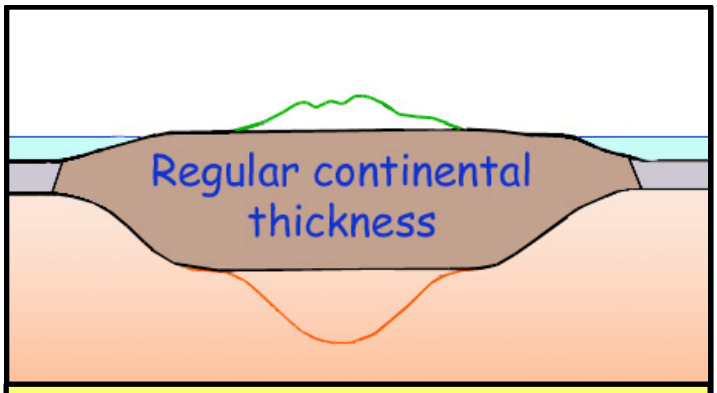
WHICH IS MUCH MORE ACTIVE ON HIGH, EXPOSED ROCK FACES. SO THE PROCESS IS AIDED BY LANDSLIDES. GRAVITY HELPS SOME MATERIAL MOVE DOWNHILL, AWAY FROM THE MOUNTAINS.



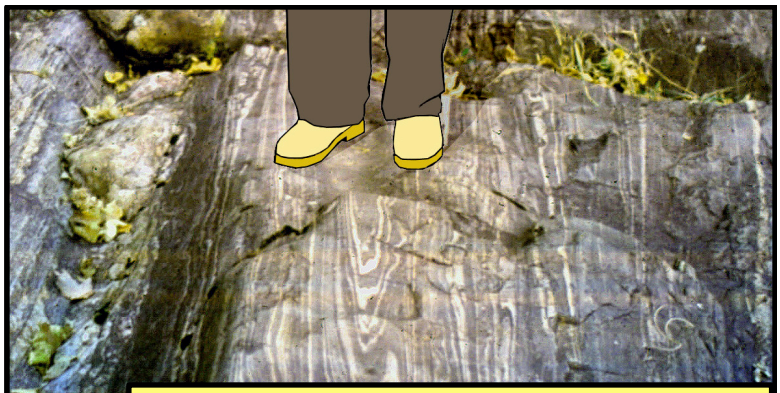








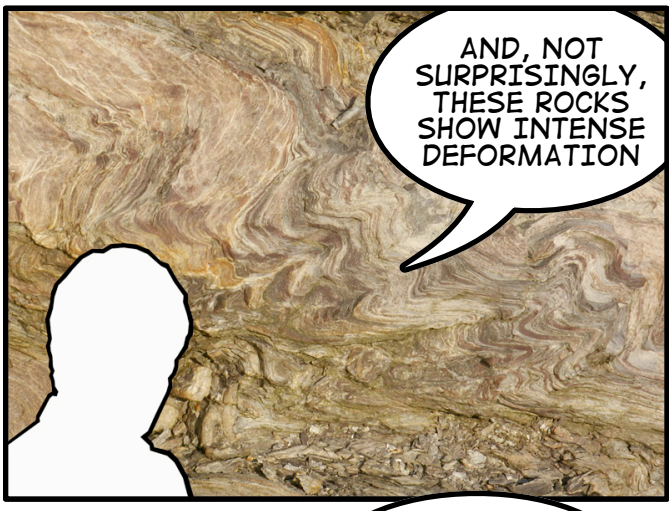
THAT THEY RETURN TO THE CRUSTAL THICKNESSES THEY HAD PRIOR TO THE MOUNTAIN FORMATION- ABOUT 20KM OR SO!



THE ROCKS BENEATH YOUR FEET CAN BE THE FOLDED REMNANTS OF ONCE MAJESTIC MOUNTAINS, EVEN IF YOU LIVE

THE ROCKS IN THESE AREAS WERE ONCE DEEP WITHIN AN ACTIVE MOUNTAIN CHAIN, AND ARE NOW EXPOSED

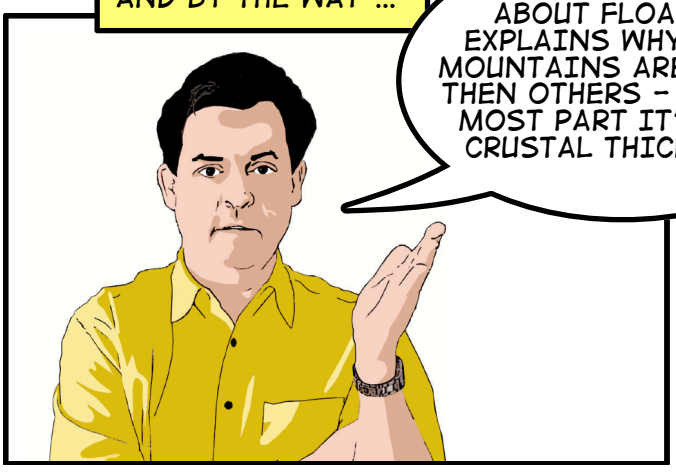
SO, IN ORDER TO SEE ROCKS THAT FORMED DEEP IN THE MOUNTAINS WE SHOULD LOOK FOR VERY OLD STRATA, PERHAPS FAR FROM ANY MODERN MOUNTAINS, LIKE THESE ROCKS EXPOSED IN VALLEY OF THE WISCONSIN RIVER - NOT A REGION KNOWN FOR ITS MOUNTAIN CHAINS.



MOUNTAIN STRUCTURES LIKE THESE EXIST EVEN IN "LOWLAND" REGIONS

PERHAPS, NOT WHAT YOU WERE EXPECTING?

AND BY THE WAY ...



ALL THIS TALK ABOUT FLOATING EXPLAINS WHY SOME MOUNTAINS ARE HIGHER THEN OTHERS - FOR THE MOST PART IT'S JUST CRUSTAL THICKNESS.