

# Continents in Collision

The Story of Mountain Building

by Ian Williams

**PART**



I'M STANDING ABOVE PEYREPERTUSE, A CASTLE BUILT IN SOUTHERN FRANCE IN THE LATE 13<sup>TH</sup> CENTURY. IT WAS A STRONGHOLD ON THIS MOUNTAIN RIDGE.

SO WHAT'S THE DEAL WITH MOUNTAINS?

BEING HIGH UP PROVIDES SOME OBVIOUS ADVANTAGES. GRAVITY IS ON YOUR SIDE!

IT'S STILL PRETTY HARD TO GET UP HERE. LOOK AT THOSE HAIRPIN\* BENDS!

\* OK, SWITCHBACKS

THAT CAR'S GOING WAY TOO FAST! LOOK OUT!

**Vrooom**

**SMASH**

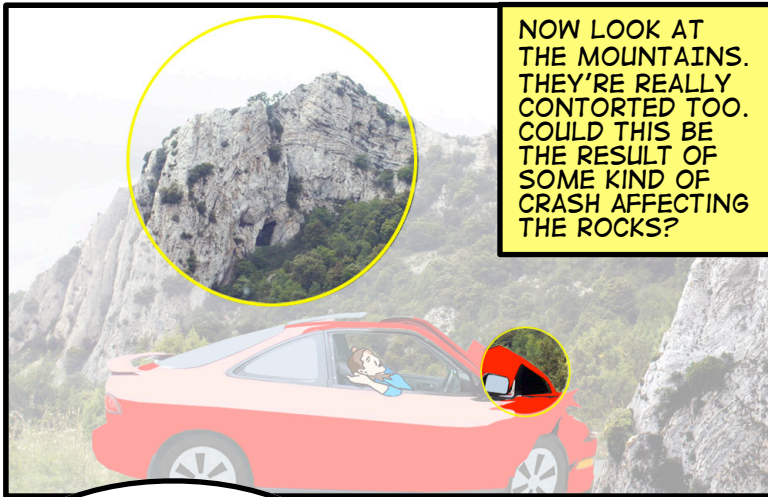
WOW! MAJOR CRUNCH. LETS GO SEE.

DRIVING IN FRANCE CAN BE A THRILL!

LOOK AT HOW BENT OUT OF SHAPE THE CAR IS! THAT CRASH EXPENDED A LOT OF MOMENTUM.

THE HOOD IS REALLY CONTORTED!





NOW LOOK AT THE MOUNTAINS. THEY'RE REALLY CONTORTED TOO. COULD THIS BE THE RESULT OF SOME KIND OF CRASH AFFECTING THE ROCKS?



THESE CONTORTIONS ARE CALLED FOLDS. THEY'RE SYMPTOMATIC OF CONTINENTAL COLLISIONS THAT TOOK PLACE MILLIONS OF YEARS AGO.

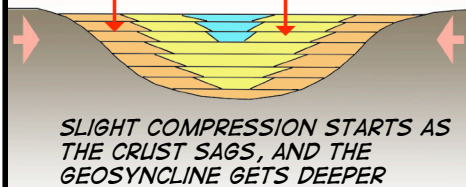
SCIENTISTS ONCE THOUGHT THAT FOLDS FORMED WHEN BASINS BECAME COMPRESSED.



THE GEOSYNCLINAL THEORY

ACCORDING TO THIS THEORY, THE CRUST SINKS ALLOWING SEDIMENTS TO ACCUMULATE IN A BASIN.

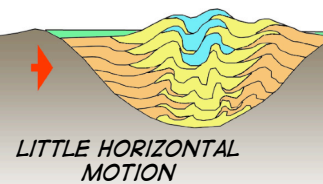
COARSE MATERIAL NEAR THE SHORE  
FINER MATERIAL THEN CARBONATES FURTHER AWAY FROM SHORE



SLIGHT COMPRESSION STARTS AS THE CRUST SAGS, AND THE GEOSYNCLINE GETS DEEPER

SEDIMENT IS ERODED OFF THE NEW MOUNTAINS.

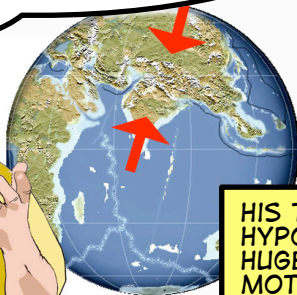
LOTS OF VERTICAL MOTION



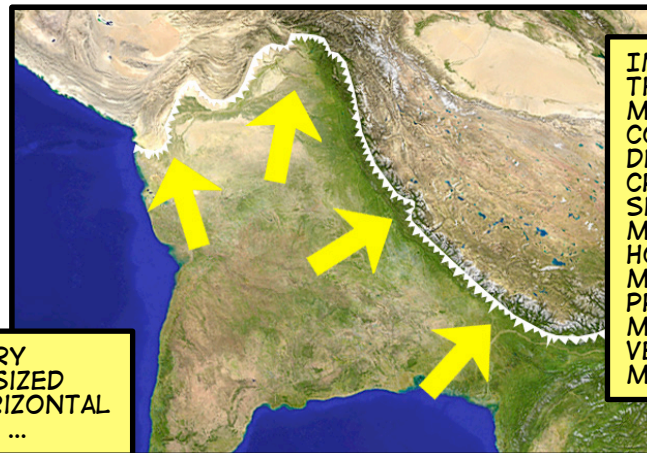
LITTLE HORIZONTAL MOTION

THIS THEORY STATED THAT MOUNTAINS ARE DUE TO MINOR HORIZONTAL MOTIONS PRODUCING MAJOR VERTICAL MOTION.

IN 1915 ALFRED WEGENER TOOK US IN ANOTHER DIRECTION, SUGGESTING THAT THE CONTINENTS DRIFT AROUND ON THE EARTH'S SURFACE.



HIS THEORY HYPOTHESIZED HUGE HORIZONTAL MOTIONS ...



IMPLYING THAT MOUNTAINS COME FROM DRAMATIC CRUSTAL SHORTENING—MAJOR HORIZONTAL MOTIONS PRODUCING MINOR VERTICAL MOTION.

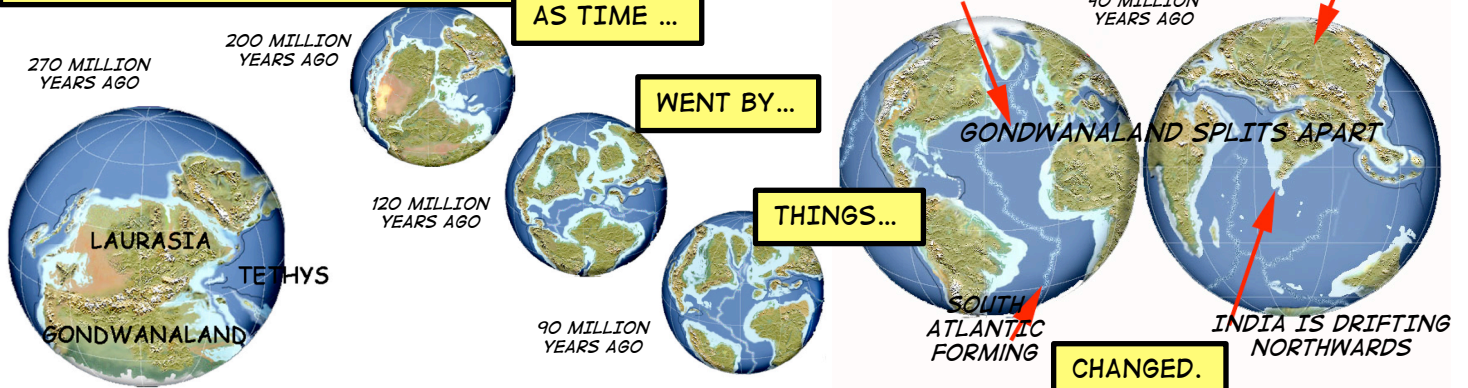
IF YOU SAW THE EARTH FROM SPACE 270 MILLION YEARS AGO, YOU WOULDN'T RECOGNIZE IT.

AS TIME ...

WENT BY...

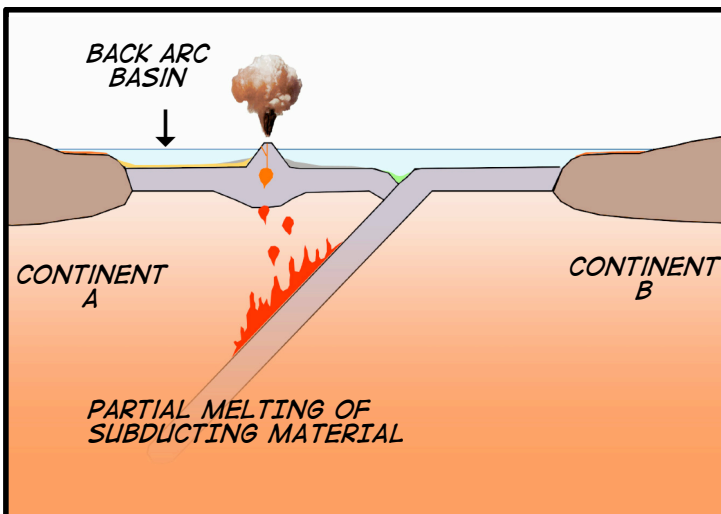
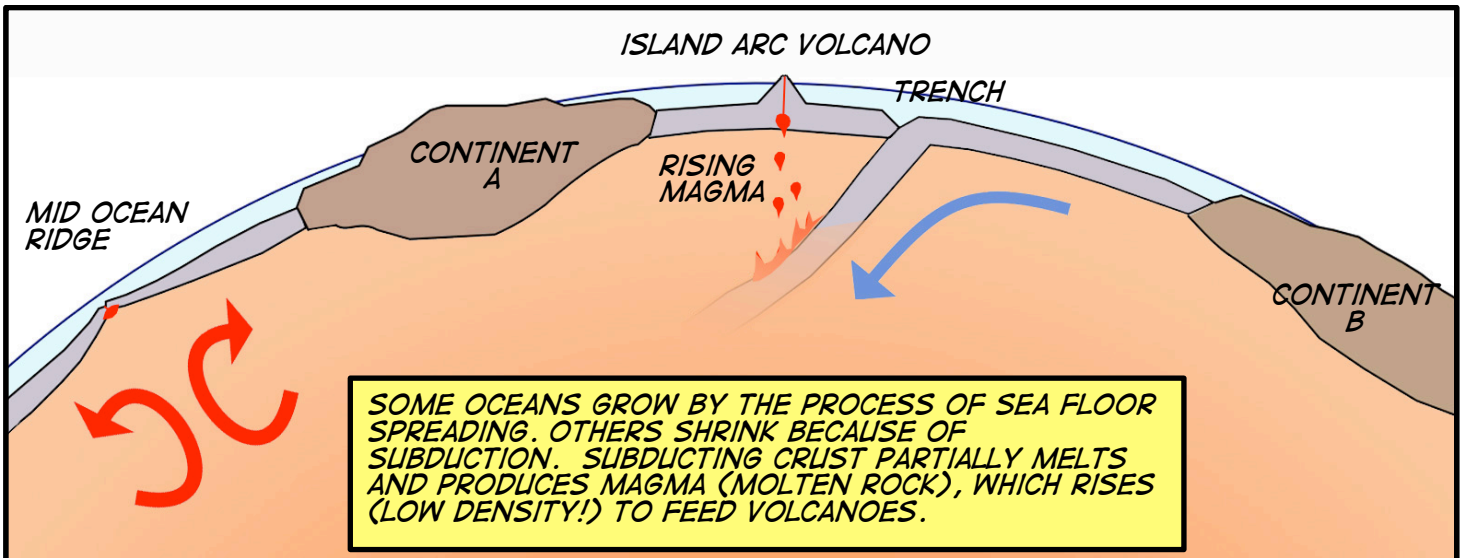
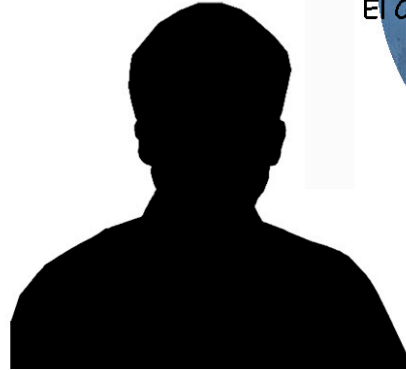
THINGS...

CHANGED.

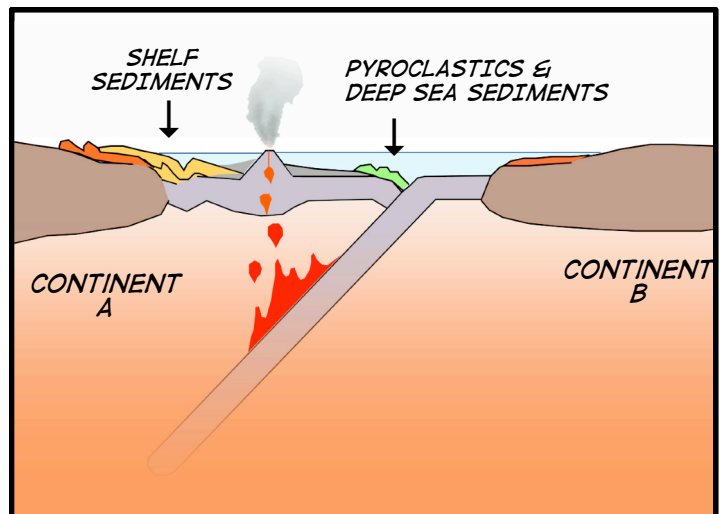




WEGENER'S IDEAS LED TO THE MODERN THEORY OF PLATE TECTONICS, WHICH HELPS US UNDERSTAND WHY THERE ARE VOLCANOES IN CERTAIN PARTS OF THE WORLD AND HOW OCEANS ARE MADE!

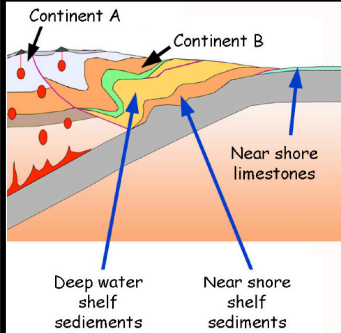


IN THE SHRINKING OCEAN, SEDIMENT ACCUMULATES ON THE CONTINENTAL SHELVES AND IN THE BACK ARC BASIN. THIS SEDIMENT IS MOSTLY MARINE IN ORIGIN, BUT THERE'S SOME VOLCANIC MATERIAL TOO.



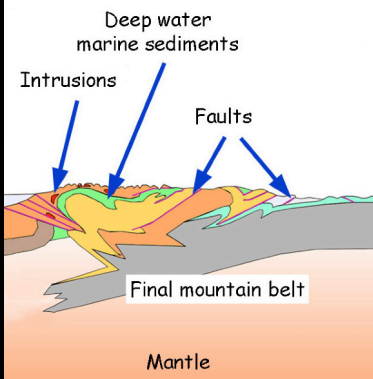
OVER MILLIONS OF YEARS, THE BACK ARC BASIN GETS ATTACHED TO ONE OF THE CONTINENTS AND THE SEA BETWEEN THE TWO CONTINENTS GETS SMALLER AND SMALLER. . .

WHEN THE INTERVENING SEA SHRINKS TO NOTHING, THEN SUBDUCTION AND VOLCANISM STOP & COLLISION STARTS.



THESE HORIZONTAL MOTIONS PUSH ONE SLAB OF ROCK OVER ANOTHER, FOLDING THE ROCKS AND MAKING THE CRUST THICKER! THIS IS HELPED BY "THRUST" FAULTS, WHICH ARE CAUSED BY COMPRESSION MOVING ONE SLAB OVER ANOTHER, OR EVEN BY DOWN-HILL SLIDING. DETACHED CHUNKS OF CRUST CAN BECOME UNSTABLE AND SLIDE AWAY FROM THE HIGHEST PARTS OF THE MOUNTAINS ...

SUTURING THE CONTINENTS TOGETHER AND MAKING FOLDS...



JUST LIKE WE SAW IN THE CRUNCHED CAR.



THIS TYPE OF BEHAVIOR WAS FIRST DESCRIBED IN THE ALPS, WHEN GEOLOGISTS FIRST REALIZED THAT HORIZONTAL MOTIONS OF TENS OF KILOMETERS HAD TAKEN PLACE THERE.

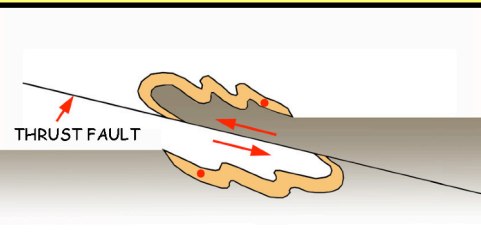


**SCRAPE!**

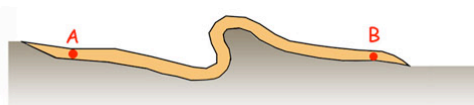
THE GLARUS THRUST WAS THE FIRST ONE RECOGNIZED FOR WHAT IT WAS.



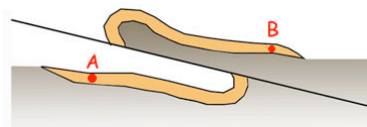
THIS, IN TURN, LEAD TO THE NAPPE THEORY, WHEREBY LARGE RECUMBENT FOLDS ARE THOUGHT TO HAVE BEEN FAULTED AND MOVED MANY KILOMETERS OVER THE "BASEMENT".



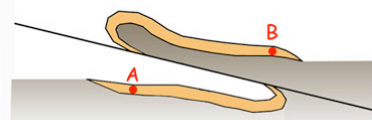
TWO PLACES (A AND B) WHICH WERE ONCE FAR APART...



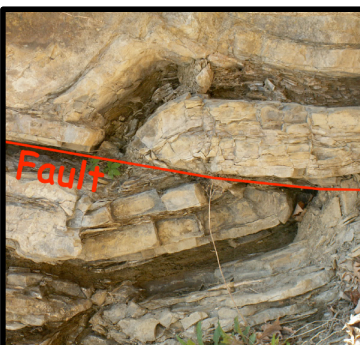
HAVE BECOME CLOSER...



AND CLOSER AS THE NAPPE DEVELOPS.



SO NAPPES ARE RESPONSIBLE FOR A GREAT DEAL OF CRUSTAL "SHORTENING".



ALL THIS CONTORTION IMPLIES AN INCREDIBLE AMOUNT OF COMPRESSION, BENDING AND BREAKING OF ONCE-FLAT ROCK LAYERS.

THIS CAN LEAD TO IMPRESSIVE CHANGES IN THE VERY NATURE OF THE ROCK ...



AND THE YOUNG LADY IN THE CAR?

AS WE SHALL SEE IN THE NEXT SECTION.

WELL, IT'S ONLY A CARTOON!

