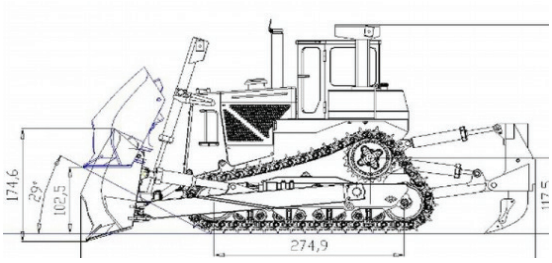
Video 4A: Water flow and water hammers

We briefly mentioned water hammers in a previous video, but we need to take a closer look at this phenomenon since it could have played an extremely important role in shaping our land masses into the forms we see today.

REVIEW:

Any type of pressure (water, air, even crowds of people) always flows from _____ to _____. This seems easy and obvious, but it can create some interesting situations. Water can flow uphill if the pressure above is sufficiently lower than below.

CONCEPT #1: LIQUID WATER IS NOT COMPRESSIBLE



In its liquid phase, water is not compressible. This means that if you squeeze it, it will not shrink and take up less space. Oil is also not compressible. Because they are not compressible, water and oil can be used in hydraulic systems. Construction equipment like bulldozers and excavators use hydraulics to push or lift heavy loads.

Experiment: If you fill a plastic bottle to the brim with water, then screw on the cap tightly, are you able to crush the bottle?

CONCEPT #2: AIR AND STEAM ARE COMPRESSIBLE

Air is made of gas molecules with empty space between them. The molecules don't want to go closer together, but if you squeeze them hard enough, they won't have a choice and will have to get closer to each other. (Have you ever used a helium tank to blow up balloons? It is amazing how much gas can come out of that small tank!)

(Review: What will happen to the temperature if you force the gas molecules closer? _____)

Steam is tiny water droplets with gas molecules and space between them. If you squeeze steam, the water and gas molecules will move closer together and take up less space.

(Review: What will happen to the temp. of the steam if you release the pressure? _____)

CONCEPT #3: SUDDENLY STOPPING THE FLOW OF WATER CAN CAUSE A "WATER HAMMER" EFFECT

If you live in a house that is heated using pipes filled with either hot water or steam, you will probably have heard a knocking sound in your pipes once in a while. This is a very small scale example of a phenomenon called "water hammer." (A related phenomenon is the "chug, chug, chug" sound and motion that water makes when you try to drain a gallon jug quickly.)

1) Watch "What is a Water Hammer?" on "Practical Engineering" YouTube channel. You can stop watching after he mentions water towers. (*If you used the water flow simulator in a previous lesson, notice information you learned about pipe size and flow rate.)*

2) Watch "What is a Steam Hammer?" on the same YouTube channel. (You don't have to watch the ads at the end.)

3) Watch "How to Collapse a Pipe by Closing a Valve" on the same YouTube channel. (A follow-up to water hammers.)

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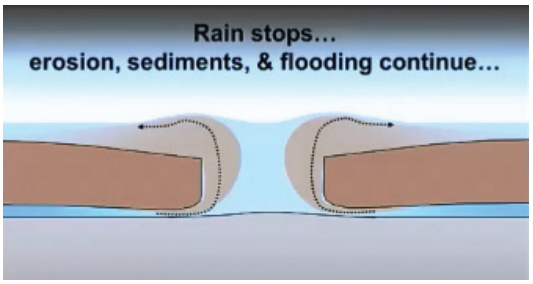
HPT discussion questions:



1) Think of two things that could have created water/steam hammers during the Rupture or Flood Phase:

a) F_____ of the crust (HINT: waving motions)

b) _____

(Hint: What else was coming out besides water?)

2) Would there also have been sudden decreases in pressure? _____

3) Could decrease be as destructive as increase? _____

4) We must not forget that the earth is a sphere and that we are not dealing with pipes! All the videos showed pipes. Water flowing out from underneath a continent might produce flutter in more than one direction. Imagine what would happen if flutter waves that started at opposite sides produced underwater pressure spikes that traveled toward each other and met under the middle of the continent. What do you think might happen? (Your ideas, no "right" answer.)

(HINT: I used Google Earth to look at topography around the globe.)