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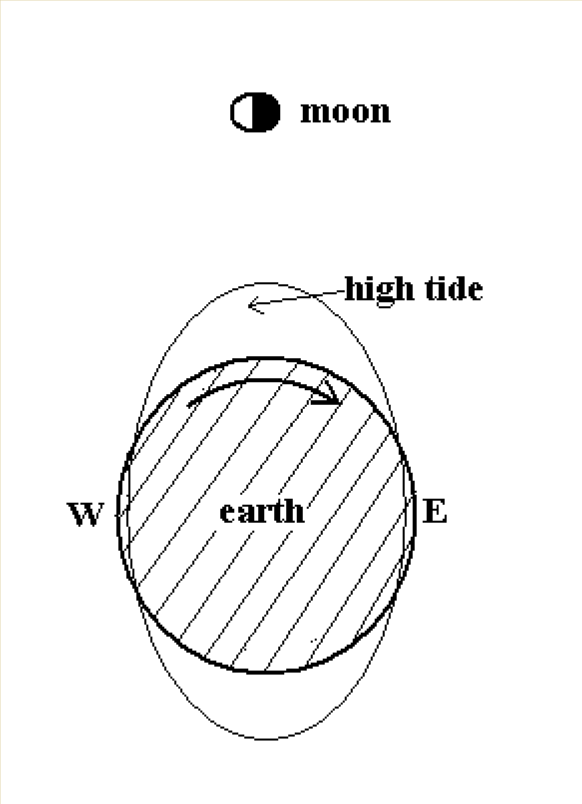
The earth is a sponge ball

The rocky internals of the earth make the earth behave like a sponge, says S.Ananthanarayanan.

The earth is a ball made up of rock, sand, ores, metals and such like, including a large quantity of water, held together by mutual gravity. All these components, hugging together, keep trying to get closer and closer together, till the earth is as nearly a close-packed ball as possible.

Squeeze and relax

While the earth is squeezed by its own weight, it also feels the gravitational pull of the moon and the sun. This is most visible in the rise and fall of the sea, in the high and low tides every 12$^1/_2$ hours. As shown in the picture, the oceans of the earth on the side nearest the moon feel the strongest gravity and get drawn away, towards the moon. At the same time, the water on the side away from the moon feels a weaker pull, but more centrifugal force, because of the movement of the earth around the sun, in the opposite direction. The result is that there is a bulge in the earth, along the line from the earth to the moon, which we see as the 'high' tide as the earth rotates.

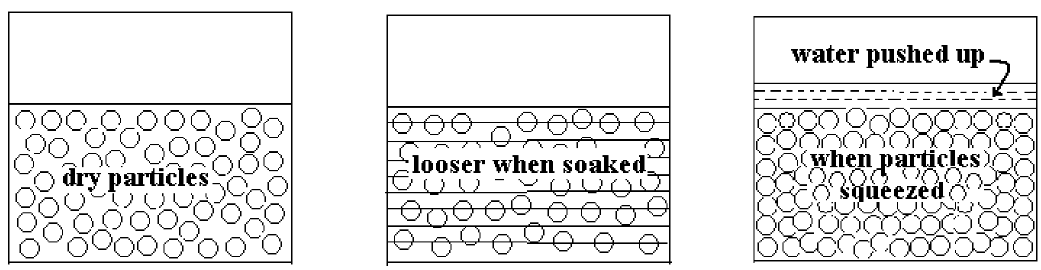


The effect of the moon on the oceans is easily visible because water can flow and assume a new shape easily. But the force of the moon's gravity is as strong on the solid parts of the earth, the plains, the hills and mountains and even deep down underground. This force causes a very slight deformation of the solid part of the earth too. The deformation is too slight to notice, but it does cause massive pressures within the mass of the earth.

And a sponge?

This is where the part of the earth being like a sponge comes in. The earth in fact, is not completely solid, like a cannon ball, but is more a collection of particles, some very small, some very large, packed together. Thus, each of the particles that make up the earth is not in complete contact with neighbouring particles, but is separated by spaces and gaps. And with the large quantity of water that covers the earth, most of these gaps are filled with water, which does play its own part in transmitting pressure and keeping the particles apart, a little.

But now, when a force is applied to the mass of particles, as shown in the picture, the particles get pressed close together and the water flows out and up! This pressure can be sudden, because of shifting land masses, like in earthquakes, or even the gradual squeeze because of the gravity of the moon, as the earth turns round.

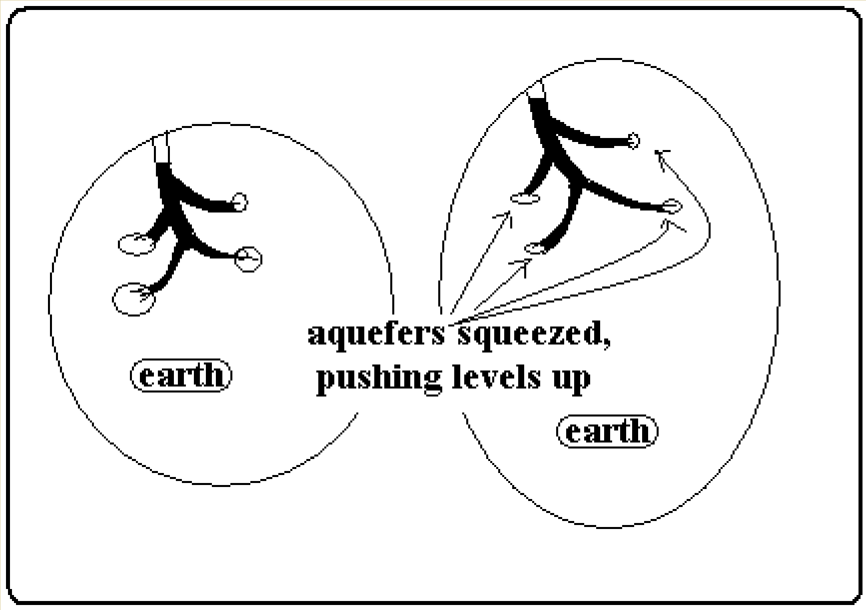


The earth soaks in water like a sponge and squirts it out when squeezed

This kind of pressure then squeezes the water out of the spaces between the particles of sand, or the rocks and boulders and can cause the levels in wells and springs to rise! And as the pressure is released, the water flows back to fills the spaces between the particles and the level falls again.

Out of step

The rise in water levels is not always exactly in step with the pressure build up in a part of the earth. Depending on how elastic, permeable and well connected the particles of the earth are, the pressure could squeeze out the water immediately or after a short delay. This delay in the rise in water level, as compared to the rising pressure, is called the ‘phase shift’.



Scientists at the Univ of California at Los Angeles studied the behaviour of water level in wells in a seismic area in southern California and they have found that the phase shift gets affected by seismic events, apparently by changes in permeability of rock that earthquakes cause.

This week's ***Nature*** carries a report of their work and remarks that artificial shocks could help ease oil or natural gas out of rocks that hold these resources

Scientists of the US Geological Survey are studying the effects that shocks have on the way soil holds water to see if the nature of prehistoric earthquakes could be worked out from the way water masses have behaved at the time of the quakes.