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Ririro

IMAGINATION OVER KNOWLEDGE

The Subterranean Furnace

"Let's get back to our subject. At the bottom of mines, I told you, a high temperature prevails, which keeps up during the whole year. There is always the same heat, winter and summer. The deepest excavation miners have ever made is in Bohemia. It is inaccessible today. Landslides have partly filled it. At the depth of 1151 meters the thermometer indicated a perpetual heat of forty degrees, almost the temperature of the hottest regions in the world. And that, mind you, in winter as well as summer. When mountainous Bohemia was covered with ice and snow, it was only necessary to go down to the bottom of the mine to pass from the rigors of winter to the insupportable heat of a Senegal summer. One shivered with cold at the entrance and stifled with heat at the bottom.

"The same conditions, without exception, prevail everywhere. The deeper one descends in the earth, the hotter one finds the temperature. In deep mines the heat is such that the most unobservant workman is struck by it and wonders if he is not near some immense furnace."

"The interior of the earth is, then, really a stove?" asked Jules.

"Much more than a stove, as you will see. The name of artesian well is given to a cylindrical hole which by means of strong iron bars, fitted end to end, is made in

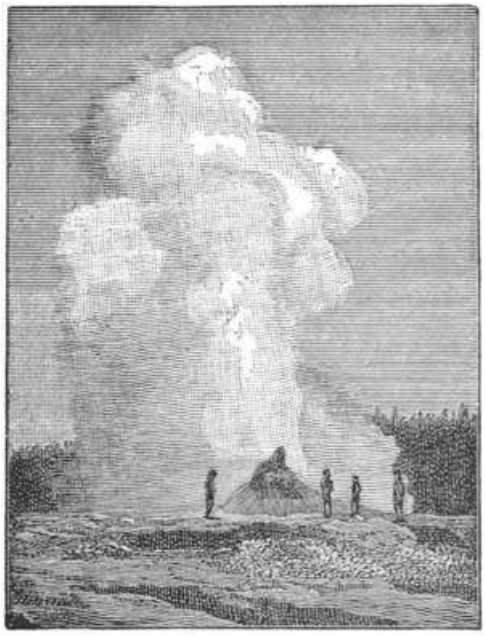
the ground until some reservoir of subterranean water, fed by the infiltrations of neighboring streams or lakes, is reached. The water that comes up from far under ground as the result of such a boring reaches the surface at a temperature equal to that of those depths; and thus we learn about the distribution of heat in the bowels of the earth. One of the most remarkable of these wells is that of Grenelle, at Paris. It is 547 meters deep, and the water in it is constantly at 28 degrees, a temperature almost as high as that of the hottest summer days. The water of the artesian well of Mondorf, on the frontier of France and Luxemburg, comes from a far greater depth, 700 meters. Its temperature is 35 degrees. Artesian wells, of which there are at present a considerable number, illustrate the same principle as mines: for every thirty meters of depth the heat increases one degree."

"Then by digging wells deep enough we should at last come to boiling water?"

"Certainly. The difficulty is to attain the desired depth. To reach the temperature of boiling water it would be necessary to bore about three quarters of a league, which is impossible. However, a number of natural springs are known which, as they come from the ground, possess a high temperature, sometimes reaching the boiling point. They are called thermal springs, which means hot springs. There prevails, then, at the depth from which they come, a heat sufficient to make them tepid, or even boiling hot. The most remarkable hot springs of France are those of Chaudes-Aigues and Vic, in Cantal. They are almost boiling."

"Do these springs make streams that are different from others?"
"Steaming streams, in which you can plunge an egg for a moment and take it out cooked."
"Then there are no little fish or crabs," said Emile.
"Certainly not, my dear. You understand that if there were any they would be cooked through and through."
"That is true."
"The little streams of boiling water in Auvergne are nothing in comparison with what are seen in Iceland, that large island situated at the extreme north of Europe and covered with snow the greater part of the year. It has numbers of springs throwing up hot water, called in that country geysers. The most powerful, or the Great Geyser, springs from a large basin situated on the top of a hill formed by the smooth white incrustations deposited by the foam of the water. The interior of this basin is funnel-shaped and terminates in tortuous conduits penetrating to unknown depths.
"Each eruption of this volcano of boiling water is announced by a trembling of the earth and dull noises like distant detonations of some subterranean artillery. Every moment the detonations become stronger; the earth trembles, and, from the bottom of the crater, the water rushes up in an impetuous torrent and fills the basin, where, for a few moments, we have what looks like a boiler heated by some invisible furnace. In the midst of a whirlpool of steam the water rises in a boiling flood. Suddenly the geyser musters all its force: there is a loud explosion, and a column of water six meters in diameter spouts upward to the height of

sixty meters, and falls again in steaming showers after having expanded in the shape of an immense sheaf crowned with white vapor. This formidable outburst lasts only a few moments. Soon the liquid sheaf sinks; the water in the basin retires, to be swallowed up in the depths of the crater, and is replaced by a column of steam, furious and roaring, which spouts upward with thunderous reverberations and, in its indomitable force, hurls aloft huge masses of rock that have fallen into the crater, or breaks them into tiny bits. The whole neighborhood is veiled in these dense eddies of steam.



Finally calm is restored and the fury of the geyser abates, but only to burst forth again later and repeat the same program."

"That must be terrible and beautiful at the same time," commented Emile. "No doubt you look at this furious fountain from a long distance, so as not to be struck on the back by boiling showers."

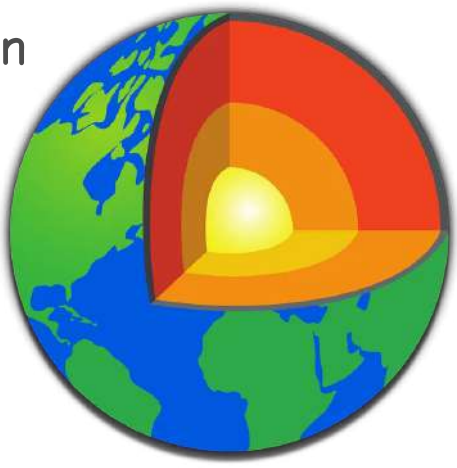
"What you have just told us, Uncle," said Jules, "shows plainly that there is great heat under ground."

"In admitting, as all these observations justify us in doing, that the subterranean temperature increases with the depth one degree for every thirty meters, it is estimated that at three kilometers or three quarters of a league down, the temperature must be that of boiling

water, that is to say 100 degrees. Five leagues down, the heat is that of red-hot iron; at twelve leagues it is sufficient to melt all known substances. At a greater depth the temperature, apparently, is still higher. Accordingly we are to imagine the earth is formed of a globe of matter liquefied by fire and enveloped by a thin crust of solid material that is upborne by that central ocean of melted minerals."

"You say," said Claire, "a thin crust of solid material; and yet, according to the calculations you have just mentioned, the thickness of the solid material must be about twelve leagues. Under that would be the melted matter. It seems to me twelve leagues make a good thickness, and we have nothing to fear from the subterranean fire."

"Twelve leagues are very little in relation to the earth's dimensions. The distance from the surface of the earth to its center is 1600 leagues. Of this distance about twelve leagues belong to the thickness of the solid crust, all the rest to the molten globe. On a ball two meters in diameter the solid crust of the earth would be represented by a thickness of half a finger's breadth. Let us make a more simple comparison, representing the earth by an egg. Well, the egg-shell is the solid crust of the globe; its liquid content is the central mass in fusion."



"And we are separated from the immense subterranean furnace only by

that thin shell!" exclaimed Jules. "That is not at all reassuring."
"I agree, it is not without a certain emotion that one hears for the first time what science tells us of these intimate details of the earth's structure; one cannot think without fear of those burning abysses that roll their waves of melted minerals a few leagues under our feet. How can a covering, relatively so light, resist the fluctuations of the central liquid mass? This fragile crust, this shell of the globe, will it not some time melt, become disjointed, crumble, or at least move? The little it does move makes continents tremble and the ground crack open in frightful chasms."
"Ah!" interposed Claire, "that is the cause of earthquakes. The liquid that is inside is stirred, and the shell moves."
"It seems to me," Jules remarked, "that this shell, comparatively so thin, ought to tremble more often."
"Perhaps not a day passes without the solid crust of the earth experiencing some shock, sometimes at one point, sometimes at another, beneath the bed of the seas, as well as under the continents. However, disastrous earthquakes are very rare, thanks to the intervention of volcanoes.
"Volcanic orifices are, in fact, veritable safety-valves, which put the interior of the globe in communication with the exterior. By offering permanent vents to the subterranean vapors that tend to liberate themselves by overturning the earth, they render earthquakes less frequent and less disastrous. In volcanic countries every time the ground is shaken by strong shocks, the

earthquake ceases the moment the volcano begins to throw up its fumes and lava."

"I well remember," said Jules, "your account of the eruption of Etna and the Catanian disaster. At first I only saw in volcanoes terrible mountains spreading devastation around them; now I begin to see their great use, their necessity. Without their air-holes, the earth would seldom be still."