

**Source: The Ten Books on Architecture
by Vitruvius
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BOOK VIII

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INTRODUCTION

1. AMONG the Seven Sages, Thales of Miletus pronounced for water as the primordial element in all things; Heraclitus, for fire; the priests of the Magi, for water and fire; Euripides, a pupil of Anaxagoras, and called by the Athenians "the philosopher of the stage," for air and earth. Earth, he held, was impregnated by the rains of heaven and, thus conceiving, brought forth the young of mankind and of all the living creatures in the world; whatever is sprung from her goes back to her again when the compelling force of time brings about a dissolution; and whatever is born of the air returns in the same way to the regions of the sky; nothing suffers annihilation, but at dissolution there is a change, and things fall back to the essential element in which they were before. But Pythagoras, Empedocles, Epicharmus, and other physicists and philosophers have set forth that the primordial elements are four in number: air, fire, earth, and water; and that it is from their coherence to one another under the moulding power of nature that the qualities of things are produced according to different classes.

2. And, in fact, we see not only that all which comes to birth is produced by them, but also that nothing can be nourished without their influence, nor grow, nor be preserved. The body, for example, can have no life without the flow of the breath to and fro, that is, unless an abundance of air flows in, causing dilations and contractions in regular succession. Without the right proportion of heat, the body will lack vitality, will not be well set up, and will not properly digest strong food. Again, without the fruits of the earth to nourish the bodily frame, it will be enfeebled, and so lose its admixture of the earthy element.

3. Finally, without the influence of moisture, living creatures will be bloodless and, having the liquid element sucked out of

them, will wither away. Accordingly the divine intelligence has not made what is really indispensable for man either hard to get or costly, like pearls, gold, silver, and so forth, the lack of which neither our body nor our nature feels, but has spread abroad, ready to hand through all the world, the things without which the life of mortals cannot be maintained. Thus, to take examples, suppose there is a deficiency of breath in the body, the air, to which is assigned the function of making up the deficiency, performs that service. To supply heat, the mighty sun is ready, and the invention of fire makes life more secure. Then again, the fruits of the earth, satisfying our desires with a more than sufficient store of food stuffs, support and maintain living beings with regular nourishment. Finally, water, not merely supplying drink but filling an infinite number of practical needs, does us services which make us grateful because it is gratis.

4. Hence, too, those who are clothed in priesthoods of the Egyptian orders declare that all things depend upon the power of the liquid element. So, when the waterpot is brought back to precinct and temple with water, in accordance with the holy rite, they throw themselves upon the ground and, raising their hands to heaven, thank the divine benevolence for its invention.

Therefore, since it is held by physicists and philosophers and priests that all things depend upon the power of water, I have thought that, as in the former seven books the rules for buildings have been set forth, in this I ought to write on the methods of finding water, on those special merits which are due to the qualities of localities, on the ways of conducting it, and how it may be tested in advance. For it is the chief requisite for life, for happiness, and for everyday use.

CHAPTER I

HOW TO FIND WATER

1. THIS will be easier if there are open springs of running water. But if there are no springs which gush forth, we must search for them underground, and conduct them together. The following test should be applied. Before sunrise, lie down flat in the place where the search is to be made, and placing the chin on the earth and supporting it there, take a look out over the country. In this way the sight will not range higher than it ought, the chin being immovable, but will range over a definitely limited height on the same level through the country. Then, dig in places where vapours are seen curling and rising up into the air. This sign cannot show itself in a dry spot.

2. Searchers for water must also study the nature of different localities; for those in which it is found are well defined. In clay the supply is poor, meagre, and at no great depth. It will not have the best taste. In fine gravel the supply is also poor, but it will be found at a greater depth. It will be muddy and not sweet. In black earth some slight drippings and drops are found that gather from the storms of winter and settle down in compact, hard places. They have the best taste. Among pebbles the veins found are moderate, and not to be depended upon. These, too, are extremely sweet. In coarse grained gravel and carbuncular sand the supply is surer and more lasting, and it has a good taste. In red tufa it is copious and good, if it does not run down through the fissures and escape. At the foot of mountains and in lava it is more plentiful and abundant, and here it is also colder and more wholesome. In flat countries the springs are salt, heavy-bodied, tepid, and ill-flavoured, excepting those which run underground from mountains, and burst forth in the middle of a plain, where, if protected by the shade of trees, their taste is equal to that of mountain springs.

3. In the kinds of soil described above, signs will be found growing, such as slender rushes, wild willows, alders, agnus castus trees, reeds, ivy, and other plants of the same sort that cannot spring up of themselves without moisture. But they are also accustomed to grow in depressions which, being lower than the rest of the country, receive water from the rains and the surrounding fields during the winter, and keep it for a comparatively long time on account of their holding power. These must not be trusted, but the search must be made in districts and soils, yet not in depressions, where those signs are found growing not from seed, but springing up naturally of themselves.

4. If the indications mentioned appear in such places, the following test should be applied. Dig out a place not less than three feet square and five feet deep, and put into it about sunset a bronze or leaden bowl or basin, whichever is at hand. Smear the inside with oil, lay it upside down, and cover the top of the excavation with reeds or green boughs, throwing earth upon them. Next day uncover it, and if there are drops and drippings in the vessel, the place will contain water.

5. Again, if a vessel made of unbaked clay be put in the hole, and covered in the same way, it will be wet when uncovered, and already beginning to go to pieces from dampness, if the place contains water. If a fleece of wool is placed in the excavation, and water can be wrung out of it on the following day, it will show that the place has a supply. Further, if a lamp be trimmed, filled with oil, lighted, and put in that place and covered up, and if on the next day it is not burnt out, but still contains some remains of oil and wick, and is itself found to be damp, it will indicate that the place contains water; for all heat attracts moisture. Again, if a fire is made in that place, and if the ground, when thoroughly warmed and burned, sends up a misty vapour from its surface, the place will contain water.

6. After applying these tests and finding the signs described above, a well must next be sunk in the place, and if a spring of water is found, more wells must be dug thereabouts,

and all conducted by means of subterranean channels into one place.

The mountains and districts with a northern exposure are the best spots in which to search, for the reason that springs are sweeter, more wholesome, and more abundant when found there. Such places face away from the sun's course, and the trees are thick in them, and the mountains, being themselves full of woods, cast shadows of their own, preventing the rays of the sun from striking uninterruptedly upon the ground and drying up the moisture.

7. The valleys among the mountains receive the rains most abundantly, and on account of the thick woods the snow is kept in them longer by the shade of the trees and mountains. Afterwards, on melting, it filters through the fissures in the ground, and thus reaches the very foot of the mountains, from which gushing springs come belching out.

But in flat countries, on the contrary, a good supply cannot be had. For however great it is, it cannot be wholesome, because, as there is no shade in the way, the intense force of the sun draws up and carries off the moisture from the flat plains with its heat, and if any water shows itself there, the lightest and purest and the delicately wholesome part of it is summoned away by the air, and dispersed to the skies, while the heaviest and the hard and unpleasant parts are left in springs that are in flat places.

CHAPTER II

RAINWATER

1. RAINWATER has, therefore, more wholesome qualities, because it is drawn from the lightest and most delicately pure parts of all the springs, and then, after being filtered through the agitated air, it is liquefied by storms and so returns to the earth. And rainfall is not abundant in the plains, but rather on the mountains or close to mountains, for the reason that the vapour which

is set in motion at sunrise in the morning, leaves the earth, and drives the air before it through the heaven in whatever direction it inclines; then, when once in motion, it has currents of air rushing after it, on account of the void which it leaves behind.

2. This air, driving the vapour everywhere as it rushes along, produces gales and constantly increasing currents by its mighty blasts. Wherever the winds carry the vapour which rolls in masses from springs, rivers, marshes, and the sea, it is brought together by the heat of the sun, drawn off, and carried upward in the form of clouds; then these clouds are supported by the current of air until they come to mountains, where they are broken up from the shock of the collision and the gales, turn into water on account of their own fulness and weight, and in that form are dispersed upon the earth.

3. That vapour, mists, and humidity come forth from the earth, seems due to the reason that it contains burning heat, mighty currents of air, intense cold, and a great quantity of water. So, as soon as the earth, which has cooled off during the night, is struck by the rays of the rising sun, and the winds begin to blow while it is yet dark, mists begin to rise upward from damp places. That the air when thoroughly heated by the sun can make vapours rise rolling up from the earth, may be seen by means of an example drawn from baths.

4. Of course there can be no springs above the vaultings of hot bathrooms, but the atmosphere in such rooms, becoming well warmed by the hot air from the furnaces, seizes upon the water on the floors, and takes it up to the curved vaultings and holds it up there, for the reason that hot vapour always pushes upwards. At first it does not let the moisture go, for the quantity is small; but as soon as it has collected a considerable amount, it cannot hold it up, on account of the weight, but sprinkles it upon the heads of the bathers. In the same way, when the atmospheric air feels the heat of the sun, it draws the moisture from all about, causes it to rise, and gathers it into clouds. For the earth gives out

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