neutral background. We must be initiated; it is an order the secrets of which are well guarded.

Leaf and Tendril (1908)

The Grist of the Gods

About all we have in mind when we think of the earth is this thin pellicle of soil with which the granite framework of the globe is clothed—a red and brown film of pulverized and oxidized rock, scarcely thicker, relatively, than the paint or enamel which some women put on their cheeks, and which the rains often wash away as a tear washes off the paint and powder. But it is the main thing to us. Out

of it we came and unto it we return. "Earth to earth, and dust to dust." The dust becomes warm and animated for a little while, takes on form and color, stalks about recuperating itself from its parent dust underfoot, and then fades and is resolved into the original earth elements. We are built up out of the ground quite as literally as the trees are, but not quite so immediately. The vegetable is between us and the soil, but our dependence is none the less real. "As common as dust" is one of our sayings, but the common, the universal, is always our mainstay in this world. When we see the dust turned into fruit and flowers and grain by that intangible thing called vegetable life, or into the bodies of men and women by the equally mysterious agency of animal life, we think better of it. The trembling gold of the pond-lily's heart, and its petals like carved snow, are no more a transformation of a little black muck and ooze by the chemistry of the sunbeam than our bodies and minds, too, are a transformation of the soil underfoot.

We are rooted to the air through our lungs and to the soil through our stomachs. We are walking trees and floating plants. The soil which in one form we spurn with our feet, and in another take into our mouths and into our blood—what a composite product it is! It is the grist out of which our bread of life is made, the grist which the mills of the gods, the slow patient gods of Erosion, have been so long grinding—grinding probably more millions of years than we have any idea of. The original stuff, the pulverized granite, was probably not very nourishing, but the fruitful hand of time has made it so. It is the kind of grist that improves with the keeping, and the more the meal-worms have worked in it, the better the bread. Indeed, until it has been eaten and digested by our faithful servitors the vegetables, it does not make the loaf that is our staff of life. The more death has gone into it, the more life comes out of it; the more it is a cemetery, the more it becomes a nursery; the more the rocks perish, the more the fields flourish.

This story of the soil appeals to the imagination. To have a bit of earth to plant, to hoe, to delve in, is a rare privilege. If one stops to consider, one cannot turn it with his spade without emotion. We look back with the mind's eye through the vista of geologic time and we see islands and continents of barren, jagged rocks, not a grain of soil any-

where. We look again and behold a world of rounded hills and fertile valleys and plains, depth of soil where before were frowning rocks. The hand of time with its potent fingers of heat, frost, cloud, and air has passed slowly over the scene, and the miracle is done. The rocks turn to herbage, the fetid gases to the breath of flowers. The mountain melts down into a harvest field; volcanic scoria changes into garden mould; where towered a cliff now basks a green slope; where the strata yawned now bubbles a fountain; where the earth trembled, verdure now undulates. Your lawn and your meadow are built up of the ruins of the foreworld. The leanness of granite and gneiss has become the fat of the land. What transformation and promotion!—the decrepitude of the hills becoming the strength of the plains, the decay of the heights resulting in the renewal of the valleys!

Many of our hills are but the stumps of mountains which the hand of time has cut down. Hence we may say that if God made the mountains, time made the hills.

What adds to the wonder of the earth's grist is that the millstones that did the work and are still doing it are the gentle forces that career above our heads—the sunbeam, the cloud, the air, the frost. The rain's gentle fall, the air's velvet touch, the sun's noiseless rays, the frost's exquisite crystals, these combined are the agents that crush the rocks and pulverize the mountains, and transform continents of sterile granite into a world of fertile soils. It is as if baby fingers did the work of giant powder and dynamite. Give the clouds and the sunbeams time enough, and the Alps and the Andes disappear before them, or are transformed into plains where corn may grow and cattle graze. The snow falls as softly as down and lies almost as lightly, yet the crags crumble beneath it; compacted by gravity, out of it grew the tremendous ice sheet that ground off the mountain summits, that scooped out lakes and valleys, and modeled our northern landscapes as the sculptor his clay image.

Not only are the mills of the gods grinding here, but the great cosmic mill in the sidereal heavens is grinding also, and some of its dust reaches our planet. Cosmic dust is apparently falling on the earth at all times. It is found in the heart of hailstones and in Alpine snows, and helps make up the mud of the ocean floors.

During the unthinkable time of the revolution of the earth around the sun, the amount of cosmic matter that has fallen upon its surface from out the depths of space must be enormous. It certainly must enter largely into the composition of the soil and of the sedimentary rocks. Celestial dirt we may truly call it, star dust, in which we plant our potatoes and grain and out of which Adam was made, and every son of man since Adam—the divine soil in very fact, the garden of the Eternal, contributed to by the heavens above and all the vital forces below, incorruptible, forever purifying itself, clothing the rocky framework of the globe as with flesh and blood, making the earth truly a mother with a teeming fruitful womb, and her hills veritable mammary glands. The iron in the fruit and vegetables we eat, which thence goes into our blood, may, not very long ago, have formed a part of the cosmic dust that drifted for untold ages along the highways of planets and suns.

The soil underfoot, or that we turn with our plow, how it thrills with life or the potencies of life! What a fresh, good odor it exhales when we turn it with our spade or plow in spring! It is good. No wonder children and horses like to eat it!

How inert and dead it looks, yet what silent, potent fermentations are going on there—millions and trillions of minute organisms ready to further your scheme of agriculture or horticulture. Plant your wheat or your corn in it, and behold the miracle of a birth of a plant or a tree. How it pushes up, fed and stimulated by the soil, through the agency of heat and moisture! It makes visible to the eye the life that is latent or held in suspense there in the cool, impassive ground. The acorn, the chestnut, the maple keys, have but to lie on the surface of the moist earth to feel its power and send down rootlets to meet it.

From one point of view, what a ruin the globe is!—worn and crumbled and effaced beyond recognition, had we known it in its youth. Where once towered mountains are now only their stumps—low, fertile hills or plains. Shake down your great city with its skyscrapers till most of its buildings are heaps of ruins with grass and herbage growing upon them, and you have a hint of what has happened to the earth.

Again, one cannot but reflect what a sucked orange the earth will be in the course of a few more centuries. Our civilization is terribly

expensive to all its natural resources; one hundred years of modern life doubtless exhausts its stores more than a millennium of the life of antiquity. Its coal and oil will be about used up, all its mineral wealth greatly depleted, the fertility of its soil will have been washed into the sea through the drainage of its cities, its wild game will be nearly extinct, its primitive forests gone, and soon how nearly bankrupt the planet will be!

There is no better illustration of the way decay and death play into the hands of life than the soil underfoot. The earth dies daily and has done so through countless ages. But life and youth spring forever from its decay; indeed, could not spring at all till the decay began. All the soil was once rock, perhaps many times rock, as the water that flows by may have been many times ice.

The soft, slow, aerial forces, how long and patiently they have worked! Oxygen has played its part in the way of oxidation and dioxidation of minerals. Carbon or carbonic acid has played its part, hydrogen has played its. Even granite yields slowly but surely to the action of rain-water. The sun is of course the great dynamo that runs the earth machinery and, through moisture and the air currents, reduces the rocks to soil. Without solar heat we should have no rain, and without rain we should have no soil. The decay of a mountain makes a hill of fertile fields. The soil, as we know it, is the product of three great processes—mechanical, chemical, and vital—which have been going on for untold ages. The mechanical we see in the friction of winds and waves and the grinding of glaciers, and in the destructive effects of heat and cold upon the rocks; the chemical in the solvent power of rain-water and of water charged with various acids and gases. The soil is rarely the color of the underlying rock from which it came, by reason of the action of the various gases of the atmosphere. Iron is black, but when turned into rust by the oxygen of the air, it is red.

The vital processes that have contributed to the soil we see going on about us in the decay of animal and vegetable matter. It is this process that gives the humus to the soil, in fact, almost humanizes it, making it tender and full of sentiment and memories, as it were, so that it responds more quickly to our needs and to our culture. The elements

of the soil remember all those forms of animal and vegetable life of which they once made a part, and they take them on again the more readily. Hence the quick action of wood ashes upon vegetable life. Iron and lime and phosphorus that have once been taken up by growing plants and trees seem to have acquired new properties, and are the more readily taken up again.

The soil, like mankind, profits by experience, and grows deep and mellow with age. Turn up the cruder subsoil to the sun and air and to vegetable life, and after a time its character is changed; it becomes more gentle and kindly and more fertile.

All things are alike or under the same laws—the rocks, the soil, the soul of man, the trees in the forest, the stars in the sky. We have fertility, depth, geniality, in the ground underfoot, on the same terms upon which we have these things in human life and character.

We hardly realize how life itself has stored up life in the soil, how the organic has wedded and blended with the inorganic in the ground we walk upon. Many if not all of the sedimentary rocks that were laid down in the abysms of the old ocean, out of which our soil has been produced, and that are being laid down now, out of which future soils will be produced, were and are largely of organic origin, the leavings of untold myriads of minute marine animals that lived millions of years ago. Our limestone rocks, thousands of feet thick in places, the decomposition of which furnishes some of our most fertile soils, are mainly of plant and animal origin. The chalk hills of England, so smooth and plump, so domestic and mutton-suggesting, as Huxley says, are the leavings of minute creatures called *Globigerinæ*, that lived and died in the ancient seas in the remote past. Other similar creatures, *Radiolaria* and diatoms, have played an equally important part in contributing the foundation of our soils. Diatom earth is found in places in Virginia forty feet thick. The coral insects have also contributed their share to the soil-making rocks. Our marl-beds, our phosphatic and carbonaceous rocks, are all largely of animal origin. So that much of our soil has lived and died many times, and has been charged more and more during the geologic ages or eternities with the potencies of life.

Indeed, Huxley, after examining the discoveries of the *Challenger* expedition, says there are good grounds for the belief "that all the chief known constituents of the crust of the earth may have formed part of living bodies; that they may be the 'ash' of protoplasm."

This implies that life first appeared in the sea, and gave rise to untold myriads of minute organisms, that built themselves shells out of the mineral matter held in solution by the water. As these organisms perished, their shells fell to the bottom and formed the sedimentary rocks. In the course of ages these rocks were lifted up above the sea, and their decay and disintegration under the action of the elements formed our soil—our clays, our marls, our green sand—and out of this soil man himself is built up.

I do not wonder that the Creator found the dust of the earth the right stuff to make Adam of. It was half man already. I can easily believe that his spirit was evoked from the same stuff, that it was latent there, and in due time, under the brooding warmth of the creative energy, awoke to life.

If matter is eternal, as science leads us to believe, and creation and recreation a never-ending process, then the present world, with all its myriad forms of the organic and the inorganic, is only one of the infinite number of forms that matter must have assumed in past æons. The whole substance of the globe must have gone to the making of other globes such a number of times as no array of figures could express. Every one of the sixty or more primary elements that make up our own bodies and the solid earth beneath us must have played the same part in the drama of life and death, growth and decay, organic and inorganic, that it is playing now, and will continue to play through an unending future.

This gross matter seems ever ready to vanish into the transcendental. When the new physics is done with it, what is there left but spirit, or something akin to it? When the physicist has followed matter through all its transformations, its final disguise seems to be electricity. The solid earth is resolvable into electricity, which comes as near to spirit as anything we can find in the universe.

Our senses are too dull and coarse to apprehend the subtle and incessant play of forces about us—the finer play and emanations of matter that go on all about us and through us. From a lighted candle, or gas-jet, or glowing metal shoot corpuscles or electrons, the basic constituents of matter, of inconceivable smallness—a thousand times smaller than an atom of hydrogen—and at the inconceivable speed of 10,000 to 90,000 miles a second. Think how we are bombarded by these bullets as we sit around the lamp or under the gas-jet at night, and are all unconscious of them! We are immersed in a sea of forces and potentialities of which we hardly dream. Of the scale of temperatures, from absolute zero to the heat of the sun, human life knows only a minute fraction. So of the elemental play of forces about us and over us, terrestrial and celestial—too fine for our apprehension on the one hand, and too large on the other—we know but a fraction.

The quivering and the throbbing of the earth under our feet in changes of temperature, the bendings and oscillations of the crust under the tread of the great atmospheric waves, the vital fermentations and oxidations in the soil—are all beyond the reach of our dull senses. We hear the wind in the treetops, but we do not hear the humming of the sap in the trees. We feel the pull of gravity, but we do not feel the medium through which it works. During the solar storms and disturbances all our magnetic and electrical instruments are agitated, but you and I are all unconscious of the agitation.

There are no doubt vibrations from out the depths of space that might reach our ears as sound were they attuned to the ether as the eye is when it receives a ray of light. We might hear the rush of the planets along their orbits, we might hear the explosions and uprushes in the sun; we might hear the wild whirl and dance of the nebulæ, where suns and systems are being formed; we might hear the "wreck of matter and the crush of worlds" that evidently takes place now and then in the abysms of space, because all these things must send through the ether impulses and tremblings that reach our planet. But if we felt or heard or saw or were conscious of all that was going on in the universe, what a state of agitation we should be in! Our scale of apprehension is wisely limited, mainly to things that concern our well-being.

But let not care and humdrum deaden us to the wonders and the mysteries amid which we live, nor to the splendors and the glories. We need not translate ourselves in imagination to some other sphere or state of being to find the marvelous, the divine, the transcendent; we need not postpone our day of wonder and appreciation to some future time and condition. The true inwardness of this gross visible world, hanging like an apple on the bough of the great cosmic tree, and swelling with all the juices and potencies of life, transcends anything we have dreamed of super-terrestrial abodes. It is because of these things, because of the vitality, spirituality, oneness, and immanence of the universe as revealed by science, its condition of transcending time and space, without youth and without age, neither beginning nor ending, neither material nor spiritual, but forever passing from one into the other, that I was early and deeply impressed by Walt Whitman's lines:—

> "There was never any more inception than there is now,
> Nor any more youth or age than there is now;
> And will never be any more perfection than there is now,
> Nor any more heaven or hell than there is now."

And I may add, nor any more creation than there is now, nor any more miracles, or glories, or wonders, or immortality, or judgment days, than there are now. And we shall never be nearer God and spiritual and transcendent things than we are now. The babe in its mother's womb is not nearer its mother than we are to the invisible sustaining and mothering powers of the universe, and to its spiritual entities, every moment of our lives.

The doors and windows of the universe are all open; the screens are all transparent. We are not barred or shut off; there is nothing foreign or unlike; we find our own in the stars as in the ground underfoot; this clod may become a man; yon shooting star may help redden his blood.

Whatever is upon the earth is of the earth; it came out of the divine soil, beamed upon by the fructifying heavens, the soul of man not less than his body.

I never see the spring flowers rising from the mould, or the pond-

lilies born of the black ooze, that matter does not become transparent and reveal to me the working of the same celestial powers that fashioned the first man from the common dust.

Man's mind is no more a stranger to the earth than is his body. Is not the clod wise? Is not the chemistry underfoot intelligent? Do not the roots of the trees find their way? Do not the birds know their times and seasons? Are not all things about us filled to overflowing with mind-stuff? The cosmic mind is the earth mind, and the earth mind is man's mind, freed but narrowed, with vision but with erring reason, conscious but troubled, and—shall we say?—human but immortal.

Leaf and Tendril (1908)

Nature Near Home