

# The Etheric Formative Forces In Cosmos, Earth and Man by Dr. Guenther Wachsmuth (Part 6)

(continued from Part 5)

The priest-scholars of the Egyptian mysteries who, without our modern instruments and without the accumulated information of our astro-physics, represented in the pyramids, among other things, the macrocosmic numerical relationships of the most remote stellar worlds, with an accuracy which our Egyptologists can only wonder at and cannot explain—these priest-scholars understood also this relation of the structure of substance to tone, a knowledge which is, unfortunately, quite lost to our age. The traditions of the Egyptians indicate to us in many ways, each independent of the other, that the two colossal statues of Memnon in the valley of the Nile gave forth every morning a tone at sunrise and greeted thus, as it were, the rise of the heavenly body. I. H. Breasted says in his well-known "History of Egypt" (p. 384) : " Only the two weather-beaten colossi (Statues of King Amenhotep III. [Memnon] which kept guard over the entrance of the temple dedicated to the moon god at Thebes.—G.W.) still look out across the plain ; one of them still bearing the scribblings in Greek of curious tourists in the time of the Roman Empire who came to hear the marvellous voice which issued from it every morning at sunrise." From other sources we derive the same information. What we of to-day can produce only on a small scale and in the reverse order in Chladni's figures, but cannot at all explain—the adaptation of certain forms of matter to certain tones—this phenomenon the Egyptian priest-scholars knew how to call forth and to control on a huge scale and in either direction.! Since they knew thoroughly the

relationship between certain tones and certain forms of substance, they were able to give to these colossal figures, as high as a cathedral, such form and inner structure that the active force of the rising sun caused this form to send forth the tone to which it was adapted. As we have said, we are able merely to wonder at the reverse process on a diminutive scale in Chladni's figures. A modern architect admitted in conversation with the author that we,

unfortunately, cannot carry through structures in the reverse sense and especially on such a huge scale. When I saw the two mighty Egyptian colossal statues in the southern valley of the Nile, it became clear to me that they must have lost the capacity of producing tone out of their form for this reason, among others, that they have been so weathered down by the millenniums as to have almost wholly lost their original form.

Let us now consider more carefully this relation of tone to substance. We have shown the " spectrum of Nature " in the following manner :

Life ether,

Chemical ether,

Light ether,

Heat--Warmth ether,

Gaseous--Light ether,'

Fluid--Chemical ether,

Solid--Life ether.

Chemical ether in the world of substance is thus adjusted to the fluid state of aggregation, and we have followed its action in the genesis of water, in the formation of clouds, and in the grand rhythms of the aqueous parts of the earth organisms. Naturally chemical, or sound, ether works, not only

in the fluid state to which it is adapted, but also in the spheres of the other states of substance. Let us follow it in its activity in the sphere belonging above it, according to the description previously given, the gaseous state—that is, the surrounding air, the atmosphere. The gaseous state is produced by light ether, an expansive force. It represents a rarefaction of substance. Chemical ether, on the contrary, is a suctional force, drawing inward ; it tends to produce a condensation of substance. What takes place when the chemical ether, or sound ether, becomes active in the light-ether sphere of the air ? A conflict ! The light ether strives for a rarefaction of substance ; the chemical ether for a condensation. This constant back and forth swing of substance, of the air, between rarefaction and condensation, at a certain point passes over naturally to its environment and sets this into rhythmic wave motion which must also be shared by the tympanum of the human ear. At this point the action of the sound ether becomes manifest to human experience. But in this connection we must not fall into the error of supposing the audible tone phenomenon originates in the human ear or in some indefinite part of the brain. The tone phenomenon arises as an entity at the moment and at the point at which the conflict begins between chemical ether and light ether over substance, for its rarefaction or condensation.

This brings us also to an understanding of the fact, hitherto not

entirely intelligible, that, when sound is produced in a vacuum—that is, in space void of air—it is not propagated. It would be more accurate to say that physically audible tone arises only when a conflict is possible between sound ether and light ether, over the rarefaction and the condensation of substance. In space void of air in which there is, of course, no substance whatever, there cannot take place, naturally, any conflict<sup>1</sup> in regard to substance or any audible phenomenon of tone. The assertion that tone produced in a vacuum cannot

propagate itself is, therefore, an erroneous statement of the case ; for an audible tone phenomenon, as a matter of course, cannot occur in a vacuum and it is for that reason that it cannot propagate itself. That it is really the chemical ether, or sound ether, which produces the phenomenon of tone in the manner explained above, when it works in the world of substance, and that it is not any other ether, everyone can experience for himself who will sing a song in a very damp space—for example, in a bath room—and then repeat the same song in a space containing dry air. The action of sound in damp space is always very much stronger because the chemical ether, or sound ether, which is adapted to the aqueous state of matter (Chap. II) exists in the fullest measure in a damp space. The fact, moreover, that sound propagates itself most effectively in water—that is, in the fluid element—has been thoroughly established through experiment. It is also characteristic that sound has been proven to propagate itself more easily from a dense medium to a rarer medium than in the reverse order, for the reason that chemical ether, or sound ether—being adapted to a denser structure of substance—\* calls forth the sound by working in the rarer substance and seeking to transfer its own principles to that substance. Naturally, we are here dealing with extraordinarily delicate differentiations in processes.

It is also significant that the propagation of sound is intensified under increased pressure—that is, when the establishment of those principles for which the sound ether always strives (contraction, Chap. II) is artificially facilitated. The inter-relationship between chemical ether, or sound ether, and the action of pressure we have already pointed out in connection with the phenomena of barometric pressure within the earth organism.

Very characteristic, finally, is the fact also that the intensity of sound is much greater at night than in the daytime ; that noises are heard much more distinctly at night

than during the day. This, which reminds us of the evidence that the darkness as a concrete manifestation of an active force—and at the opposite pole to the activity of light (see *The Theory of Colour*, Chap. VIII)—is to be ascribed to chemical ether, as we were able to establish in the case of nocturnal currents generated by the action of the moon, and the phenomena caused by the moon during the eclipse of the sun, and also otherwise. The striking parallelism of increased darkness and increased intensity of sound at night is thus intelligible to us as resulting from the dependence of both phenomena upon the same ether.

Since we live within the organism of the earth with its present etheric structure, we therefore perceive the light, colour, and tone phenomena with our present waking consciousness only in the manner in which these phenomena there manifest themselves. For the perception of light, colour and tone, as these arise in other spheres of activity of the etheric formative forces, we require the adaptation of our consciousness to these altered relationships. Sound ether is naturally not restricted exclusively to these tone phenomena which it produces in the lowest levels of the atmosphere, where we live, through the conflict for the condensation or rarefaction of substance—that is, of the air. But in these spheres of the earth organism it always produces tone-phenomena in the manner we have here explained.

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Goethe : “ Prologue in Heaven

Raphael. The sun-orb sings, in emulation,

’Mid brother-spheres, his ancient round :

His path predestined through Creation.

He ends with step of thunder-sound.

The angels from his visage splendid Draw power, whose measure  
none can say;

The lofty works, uncomprehended,  
Are bright as on the earliest day.

Gabriel. And swift, and swift beyond conceiving,

The splendour of the world goes round,

Day's Eden-brightness still relieving The awful Night's  
intense profound :

The ocean-tides in foam are breaking,

Against the rocks' deep bases hurled,

And both, the spheric race partaking,

Eternal, swift, are onward whirled I

Michael. And rival storms abroad are surging From sea to land,  
from land to sea,

A chain of deepest action forging Round all, in wrathful  
energy.

There flames a desolation, blazing Before the Thunder's  
crashing way :

Yet, Lord, Thy messengers are praising The gentle movement of  
Thy Day.

All Three. Though still by them uncomprehended,

From these the angels draw their power,

And all Thy works, sublime and splendid,

Are bright as in Creation's hour.

(Translated by Bayard Taylor, London, 1371.)

## Chapter X

### THE SHAPING OF SUBSTANCE, THE DISSOLUTION OF SUBSTANCE, AND RADIO-ACTIVITY

THE decay of substance, which has been revealed through the research of the last decade in the phenomena of radio-activity, has become one of the most essential components in our conception of the world. Moreover, it has furnished the evidence to prove that the transitory life of our present cosmic system (from genesis to heat-death) may be viewed, not only in its process of becoming, but also in its decay and processes of death, by man, who shares in this experience.

That this dissolution of substance proceeds spontaneously and apart from human interjection of chemical or physical influences has been completely established by present-day research in radio-activity. This dissolution is, therefore, for the present free from any arbitrary human will.

It was formerly supposed that the phenomena of radio-activity were attributes of certain special minerals. But it has been possible to prove, as Professor St. Meyer and E. von Schweidler state in their frequently cited work "Radioaktivitat" : " That not only the minerals actually containing uranium and thorium, but almost all natural forms of rocks and soil contain radio-active ingredients/' The content, therefore, of radio-active elements and the resulting evolution of heat in the most widely diffused forms of rock which compose the crust of the Earth are of essential significance for the ' warmth-household 1 of the globe. In particular, research in radio-activity has shown that the methods whereby until now the age of the Earth's crust has been mathematically calculated has lost sight of reality. Dr. Kahler cites, furthermore, in his volume on " Luftelektrizitat " (p. 117), the experimentally established fact " that radio-active substance is mingled directly with the air," and not only bound up with the solid outer crust of the earth. " Sea

water shows likewise a slight but evident radio-activity " (p. 125). Further on he asserts, " Snow often manifests radio-activity," and elsewhere, " The radio-activity of the substances precipitated varies. In

general, in proportion to the quantity of water, it is greater in snow than in rain/' Finally, it has come to light that the air of the atmosphere, the air we breathe, is continually taking up the radio-active emanations of the earth's crust, and we have been able to follow this rhythmically coursing process while considering the process of breathing of the earth organism (Chap. III). We see thus from all these experiments that radio-activity reveals itself in all spheres and all elements of the earth organism. (Its consequent important influence upon man, composed, as he is, of the elements of the earth and living in the earth organism, we shall later take under separate consideration.)

Before we enter into a discussion of the phenomena of radio-activity

itself, it may be well to remark briefly upon a phenomenon which can

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be understood as a component part of radio-activity only out of macro-' cosmic relationships. It has been discovered that radio-activity is most strongly marked in connection with substances of the most complex composition, and especially those terrestrial elements " to which, of all elements, belong the greatest atomic weight." Furthermore, it has been learned that products of the radio-active dissolution series are isotopes of lead—that is, that the most intensively dissolving substances in the earth organism are similar in nature to lead. I may be permitted here to call attention to the fact that in those spiritual traditions of Orient and Occident where much was known of the relation between macro cosmic and

microcosmic processes without the apparatus of the astrophysics of our age, lead, on the one hand, was always accompanied by the sign of Saturn b , and, on the other hand, the oldest state of the cosmic system was also called the " Saturn state." Modern research has now established quite indisputably and quantitatively this relation between lead and the most complicated element of substance, most subject to dissolution. In the case of the spiritual teachings mentioned above, these weighty matters were known, associated also, of course, with qualitative attributes.

The discovery of this spontaneous dissolution of substance has led to a more thorough investigation of that small entity of substance called the " atom," and we shall now endeavour to arrive at a conception of the inner structure of the unit of substance.

Modern research seeks, of course, from all directions, to arrive at this important goal. We shall not now enter into the debate for and against the atomic theory, but shall only remark in regard to the theory that, although qualitative and quantitative characteristics are not arbitrarily separated, as they never are in reality, yet one can, in a sense, speak of the smallest entities of substance just as we speak of greater units, such as Earth, Sim, Saturn, and the like. Naturally,

for a basis of discussion—as, indeed, both sides admit. Therein lies a world peril. The wisdom of the West, built upon natural science, and the wisdom dominant for thousands of years in the Orient contain concepts so unlike in meaning that the approaches attempted reciprocally during recent decades with all mutual good-will have only made the difficulties greater than ever, since we have thereby for the first time brought into conscious realization the almost unbridgeable gulf between the two groups.

Whoever, therefore, does not wish merely to increase Occidental natural science and export this to the Orient, nor

merely to transplant the Eastern conception of the world to an Occident quite unadapted for its reception,—such a person faces the task of discovering, first of all, a form of expression and a nomenclature intelligible to both sides in which to discuss Nature and the forces at work in Nature. For the helping forward of the Occident alone or of the Orient alone no longer signifies helping forward humanity as a whole ; it signifies rather the strengthening of the opposition between East and West, and is therefore working toward the ruin of humanity.

It is a duty, therefore, to point out that in the following pages an effort had to be ventured upon—in accordance with a quite definite Suggestion of Dr. Rudolf Steiner—to present certain phenomena drawn from our knowledge of Nature in such a way that these might be discussed at one and the same time with both Occidentals and Orientals. The “ Western key ” to this forum of discussion was expected to be furnished by the knowledge derived from modern natural science; and the “ Eastern key ” by that derived from certain parts of the primal wisdom of the Orient, which arose by the Indian cradle of human evolution and left its impression, often greatly falsified, in the Sanskrit texts and the Vedanta and Yoga philosophies, as well as their derivative cultures. This is to be, then, not a struggle between mutually hostile concepts, but the search for a new synthesis. Two different keys are to throw open the same realm of knowledge. What is to be attempted, therefore, is to be a twofold work of translation,—on the one hand, a translation of the mechanistic science of the Occident, seemingly contradictory of the fundamental religious conceptions of the whole human race, into such a mode of presentation as opens again the doors to the realm of the spiritual and of religion ; on the other hand, a translation of the Oriental teaching of the world-building forces, given mostly in pictures and in the forms of dialogues, into such a form of expression as will render possible its application to the mastery of matter. It is in

this latter work that the Occident, in spite of its giving a secondary place to the religious element, has achieved so much. The West has employed its knowledge

of world-laws primarily, indeed, for the mastery of force and substance in the external world ; the Orient has used its knowledge of world-laws primarily for personal spiritual discipline. The result of a Western knowledge of Nature leads mainly to the construction of some sort of machine. The result of Eastern knowledge of Nature was clothed in the utterances of a god or a teacher to his disciples for the purposes of purely spiritual practises. But each human group needs both these results. And the world-laws are certainly, in the last analysis, the same for both. If, then, students of the ideas of Newton, Laplace, Helmholtz, Hertz, Einstein, and others and the students of the teachings set down in Oriental philosophy concerning the forces of Nature\* should place their concepts and nomenclature within the conception of the world here presented, both would be brought to the same orientation of thought regarding the forces that build and move the universe—an orientation of thought doing justice to the conceptual systems of both groups.

To many persons this may seem at present absurd or far-fetched. But the attentive observer of the present world status will strive to follow this path as the sole way of salvation for the coming decades. To strive toward a goal does not mean that one has reached it; but it' has now become a matter of duty to move in that direction. We do not here address that sort of stay-at-home among scholars and scientists who believes he can ignore the problem of Orient and Occident because his laboratory is some thousands of miles from Asia or from America, or else because this problem lies outside his special province. World history in its onward march will not respect the seclusion of such scholars' studies.

But whoever looks upon scientific research, not as a thing

good in itself, but as a task which must from time to time be adjusted to changes in world history, must to-day at least endeavour to speak of the idea of the world in such a way that a common basis of discussion may thereby come into existence for both Occidental and Oriental.

In order to preclude misunderstanding, we must caution the reader that what has just been said applies solely to the method of presentation of the formative forces and cannot affect in the least the facts themselves, or the content of the knowledge in itself. The content of what is to be said regarding these forces and their activity is the result of objective natural-scientific research, and as such is unrelated to the problem of Orient and Occident. Since, however, any knowledge possesses true value for men

T \*^ee Guenther Schubert: " Indische Bezeichnungen fur die Atherarten" ( Indian Designations for the Kinds of Ether"). Gaa-Sophia, Yearbook of the atural Science Section at the Goetheanum, 1926.

all these greater or lesser units may be converted further into still greater or still smaller units. We must realise most of all that, just as the greater units (the planetary, for instance) are in a process of metamorphosis and are distinct in nature from one another, so also the smallest entities of substance are not forever immutable, and these also will manifest different characteristics in the different elements. Thus an entity of the substance lead will be different from one of gold, copper, iron, etc. Yet they will all manifest certain traits in common because they are all subject to the general terrestrial laws. We shall here discuss these common characteristics. To those who do not seek to understand single phenomena tom apart from their inter-relationships, but endeavour to apply an organic conception even to single members in the system of substance, the phenomena connected with radio-activity and the substance unit in which they occur are best understood, in the light of

reality, by comparison with the structure of the earth organism. While we shall naturally never be able to establish by means of our senses the most minute units of substance called the "atoms," we understand at once what occurs in such a microcosm by comparison with its greater archetype which is accessible in much greater degree to our actual observation.

Illlll Warmth ether IIIIU Light ether min Chemical ether  
illlll Life ether

(The whole is naturally not static, but in constant motion within the spheres, and the spontaneous radiation is irregular. Through the pink rays radiation is

intended to be schematically indicated.)

Picture of the earth organism, and likewise of the substance unit.

Let us now apply to this model of substance, corresponding to the earth organism, that which has been proven by means of research in radio-activity.

In connection with the spontaneous dissolution of substance in radio-activity, there come to light primarily four concrete, experimentally confirmed activities:

- (a) Heat activity,
- (b) Light activity,
- (c) Chemical activity,
- (d) Activities affecting life processes.

(a) A unit of substance is vitally interpenetrated by centrifugal forces, on the one hand (warmth ether and light ether), and on the other hand by centripetal forces (chemical ether and life ether). Radio-active substances are always somewhat warmer than their environment, which is a result of

the action of warmth ether released by the process of decay, not of any sort of inexplicable hypothetical " transmutation of energy." It has been experimentally proven that phenomena of radio-activity are entirely free from the influences of external temperature. Professors St. Meyer and E. von Schweidler proved conclusively the following very interesting fact: " The development of heat is, first of all, surprisingly great. It reaches such a degree, as more recent research has shown, that radium will always bring approximately 1J times its own weight of water from the freezing to the boiling point in one hour. Similar phenomena were then established for the other radio-active substances " (p. 13). Warmth ether may thus be easily demonstrated as a formative force self-existent and coming to manifestation through the dissolution of substance.

(b) The phenomena of light in connection with radio-active substances rest upon the action of light ether and life ether, as we have described this action previously under other relationships. It is " pure light " (Chap. VII), for it is entirely independent of processes of combustion and heat. It has been experimentally proven, as we have said, that phenomena of radio-activity are entirely free from the influence of external temperature. The effects of light have been proven to come from those outer zones lying around the inner kernel of the entity of substance—that is, from the light ether sphere of the preceding diagram, so that there is here a complete correspondence with the description of the earth organism given earlier. All radio-active mixtures always form the threefold oxygen, ozone. The luminosity of radium is not dependent upon previous treatment with solar rays, for life ether and light ether are released through the dissolution of substance and express themselves in phenomena of light just as this happens on a large scale in the earth organism.

(c) The chemical action of dissolving units of substance is manifold. The metamorphosis of white phosphorus into red

through certain radioactive rays is certainly to be ascribed especially to the release of warmth ether (see Chaps. VII and VIII). The hitherto observed contradictory effects—that radio-active substances at one time decompose water and at another time form water, and in the same way sometimes form ozone, and sometimes destroy it—may now be explained indisputably; for these things depend upon which of the etheric formative forces from the radio-active substances at the moment act upon the other substances in question. Life ether and light ether will form ozone ; warmth ether will destroy it; chemical ether will form water ; light ether will not, etc. It would at this point take us too far afield to discuss each individual phenomenon thoroughly on the basis of the etheric formative forces as these have been described. Anyone who is intimately familiar with radio-active processes will, however, admit that many of the phenomena he has heretofore observed can be very differently interpreted when these are viewed in a living way, in the light of the above analysis of the unit of substance with an inner structure similar to that of the earth organism.

(d) Very important are the influences of dissolving substance and the action of its forces upon the phenomena of life. As to this the work of Professors St. Meyer and E. von Schweidler furnishes an abundance of very interesting evidence. Men, animals, plants, and minerals, everything created—all are subject to this action. Minerals are influenced in the crystallization processes (see Chap. XI) ; plants in their vital element, chlorophyll; man in his blood and many other parts of his organism. The therapeutic significance of radio-active substance in the sources of all curative baths in the world—such as Karlsbad, Gastein, Baden-Baden, Nauheim, etc.—has been disclosed, indeed, in the last decade though not yet explained. Dr. Kahler says in “ Luftelektrizität ” (p. 125) : “ Those springs which have come to be known as curative manifest a high degree of activity/”

Here let us demonstrate in the most penetrating fashion the difference between a merely quantitative and a qualitative manner of viewing the world. The life ether released from the dissolving substance breaks through all the fetters of a merely quantitative understanding. Like the cosmic formative forces which penetrate into the outer spheres of the earth organism (pp. 126-128), it not only forms the ozone, so vitally important, but reaches deep into the phenomena of life. The physiological effects of these released forces are almost all-comprehensive (St. Meyer and E. von Schweidler, p. 199) : " The checking of fungus growths ; the destruction of germinating force in seed ; the checking of the growth of roots and buds and whole plants ; acceleration of defoliation, etc. ; atrophy of parts of flowers ; stoppage of the development of the embryo-sac ; degeneration in cell nucleus, etc., etc." Nageli says in his work on " Blutkrankheiten und Blutdiagnose " (p. 171) : " In so far as researches up-to-date have established conclusions, one must assume a twofold action of the Rontgen rays : 1. A direct destruction of the cells in the organs under radiation ; 2. an indirect influence exerted upon organs not under radiation by means of a Rontgen toxin in the sense of a retardation of the cell formation and an approach of the cytogenesis towards the normal mode. Radiation with radium shows effects which correspond to those produced by Rontgen radiation upon the bloodgenerating organs." But the effect upon the phenomena of life in man, animals and plants depends directly upon the intensity of the action. A high degree of intensity is often destructive, where a low intensity is upbuilding, beneficial. This, however, is most of all dependent upon the particular organism upon which the influence operates ! A science which, in applying these etheric formative forces does not base itself upon the conception of the etheric body of organisms, of men, animals, and plants, as it is here observed in relation to the most varied organisms, might, in spite of the utmost goodwill, occasion an unpardonable catastrophe in the world of the living, of organisms, by means of the newly disclosed forces

as they come within arbitrary human control through the dissolution of substance. With the discovery of the forces which are released by the dissolution of substance—which, of course, have always existed but now for the first time become subject in increasing measure to arbitrary human control—the merely quantitative research into the world becomes a world peril.

The first bold investigators in radium have had to suffer in the course of their investigations the mutilation of limbs, a fact which brings a shuddering fear to those who do not close their eyes to the fact that these unexpected experiences may prove to be a mere beginning of the intensification of such phenomena whose meaning for the future evolution of living beings, and most of all the evolution of man, can scarcely be surmised in our day.

Only by drawing upon the knowledge of the ether body and the other essential members of the human being, as anthroposophical spiritual science represents these in our time from a spiritual source of knowledge, can we save humanity from encountering a calamitous confusion in the world of forces just as unexpectedly as the political world stood amazed and helpless before the catastrophe of the war and academic political economy before the consequent chaos in our national economic life.

In conclusion we may glance at the outlook for unified research into organisms and its future tasks in connection with the discoveries of radio-activity.

In relation to the appearance and extinction of species of animals and plants in different parts of the earth organism—to which we have already referred in Chapter III—it must be pointed out further that the phenomena of dissolution of substance, linked with the etheric processes, for which radio-activity is merely one of many manifestations, are of varying degrees of intensity in different " geographic " parts of the

earth organism, a fact which will in future explain many a riddle in the sciences of ethnology, zoology, and botany. Minerals, water and air for breathing are quite differently interpenetrated by the etheric formative forces in different parts of the earth. This geographically varying action of the etheric formative forces in minerals, water, and air for breathing—that is, in those components, which form the bodies of plants, animals, and man in the different parts of the earth and influence their vital phenomena---belongs among the causes of the differences distinguishing the races of men and varieties of animals and plants. With the variation in the etheric structure of a particular geographic complex, there vary also the conditions essential to life, and with these the phenomena of life, among plants, animals, and men in that region of the earth, (This matter we shall discuss more in detail in Volume II.) Biological investigators who desire to understand the appearance and disappearance of races and species in the kingdom of life and their variations will in future be forced to pass over into a study of “ etheric geography ”—that is, research into the geographically varying activity of the etheric formative forces in the earth organism.

In this research it will be possible, among other things, to work from the basis of an investigation of the modifications which units of substance undergo in the various regions of the world, since these, as we have seen, reproduce in miniature the picture of the earth organism. The model of the earth organism is also the model of the smallest units of substance, which, however, go through their metamorphoses according to the different influences of the various regions of the earth and thus are more and more varied and individualized in space and time.

## Chapter XI

### THE SHAPE-BUILDING FORCES AND ARCHETYPAL FORMS IN NATURE AND THE REALITY

IF we wish to penetrate with full understanding to the genesis of form-building in Nature, we must once more begin with the primal states, the states of aggregation of matter (Chap. II), as Mr. Rudolf Steiner has done in his second course of scientific lectures, with a tremendous range of vision over the most varied fields of scientific research. Here we shall endeavour to sketch briefly the wide range of these ideas and to place them in mutual relationship with what has been said in the preceding sections in regard to the etheric formative forces.

Fundamental for the understanding of form-building is the fact that expansion is a very different thing in the case of different solid, fluid, and gaseous substances—that is, that the co-efficient of expansion for solid and fluid bodies varies according to the substance which expands ; whereas this is identical for all kinds of gaseous substances. Expressed differently, the identical capacity of expansion of all kinds of gases is changed in the transition through the liquid to the solid state into a differentiated, individualized capacity for expansion for each individual solid substance. Here also we see that in the transition to the gaseous state there comes about a unification of all substances on the earth; whereas, in the transition to the solid state there appears an individualization, a differentiation towards individuals. We are here dealing with a polaric contrast: with gaseous bodies a surrender of individuality, of shape, of form ; with the solid bodies a demand for individuality, a thing's own shape, a special form.

We must now ask ourselves : What is it which actually shapes, which individualizes ? Let us recall the various functions of the etheric formative forces within the earth organism. We have recognized two groups of forces working in polaric opposition : on one side warmth ether and light ether, the centrifugal forces which tend outward from the solid earth with the earth's atmosphere ; on the other side chemical ether

and life ether, which hold together the earth organism. It is, therefore, the two latter forces which render possible the earth organism as it is,

as a self-contained individuality. But they do this, not only for the earth organism as a whole, but also for all those individual bodies within the earth organism which exist in either the fluid or the solid state, adjusted to the chemical or the life ether. The life ether as a free force brings about not only the sundering of the earth organism from the cosmos, its individualization, but also the sundering from the earth organism of each single body within it. Ancient schools of wisdom---for example, those of Greece,--which had a great deal of intuitive knowledge of these things, for that reason called the solid state the " Earth " state, thereby expressing the fact that a body which comes into the solid state enters thereby wholly into subjection to the earth's laws.

This path toward individualization now moves in a manner which is amazingly symptomatic both for the macrocosm and for the microcosm. A gaseous substance tends always to break through the form imposed upon it; it tends to release itself into the world in every direction. If I wish to give it a form, I must surround it on every side. Not so the fluid body. It also tends to break through a form imposed on it, but not in every direction. We do not need to hold water in a vessel closed on all sides. Though we must surround it with a shaping form below and at the sides, it shapes its own form above. And what is this form ? The form of the earth as a whole! We call this the water-level, but it always takes the form of a sphere whose centre coincides with the centre of the earth.

Finally, in the case of solid bodies that which in the case of water is directed toward the centre of the earth is transferred to the inside of the individual, differentiated body itself. What is shaped by the whole earth in the case of an aqueous body--the water level--is shaped on every side by the solid body itself. By taking in the life ether, the force of

gravity, it has taken over within itself the earth force ; it is individualized.

We may summarize as follows : Gas opposes the earth's laws of form ; will not submit, like the other states of matter, to the earth relationships ; tends away from the laws of the earth in order to return to cosmic laws. It denies the sundering, individualizing process toward w'hich the earth tends as opposed to the cosmos ; its tendency is anti-individual.

The watery, or fluid, substance is subject to the laws.of the earth only in part, in that it permits itself to be given its level, its form on its upper surface, by the earth forces tending towards the centre of the earth. But this shape is common to all fluids in the earth organism and is, therefore, not individual. For the rest, the fluid has the same form-denying tendency as the gaseous. It is thus a medium state between purely cosmic and purely terrestrial laws. Solid bodies, finally, take over into their own interiors the same form-shaping forces which are common to all watery things in the earth organism ; they completely individualize in themselves the " earth state."

Thus we see :

( have anti-individual form-( tendencies.

( partly anti-individual, parti}' l individualizing, form-tendencies.

( purely individualizing form-l tendencies.

Warmth ether-heat Fight ether--gaseous substances

Chemical ether-fluid substances Fife ether-solid substances

Let us here examine more closety these form tendencies of the etheric formative forces in the several kingdoms of Nature. We have said (Chap. II) that these formative forces, when they

work in the world of substance, show a tendency to shape the following basic forms :

Warmth ether : spherical forms

Light ether : triangular forms.

Chemical ether : half-moon

forms {giving, when c o m -pletecl, a circle or a globe).

j j Life ether : square forms.

How the manifold other structural shapes proceed from these basic forms we shall now inquire.\* Indeed, these four basic forms are brought before us in all the kingdoms of Nature if we look with living vision ;

\* Exceedingly important and very instructive in their bearing upon the genesis of primal forms and their transition, one into another, are the representations given by Dr. Ht von Baravalle in " Geometric in Bildern \*" {Stuttgart, 1926).

in what follows here, we can naturally select only a few characteristic examples.

When salt dissolved in water crystallizes out of the fluid into the solid state, it takes the square or rhomboid shape as its basic form. Here is manifested the action of life ether. According as the other etheric forces work together in the various chemical elements during their crystallization, there arise triangular or spherical forms, or mixed forms.

Very striking does this conformity of the several basic forms with the corresponding formative forces within the earth organism become in the case of hail, rain, snow and the like—that is, those shaped substances which fall down to us from the upper atmosphere. What forces are active in their individual shaping has hitherto been hidden behind a dense veil. In his interesting book " Meteorologie," already cited

many times, Professor Trabert writes : "In relation to the formation of hail, the points of view are not yet clarified. It is certain that in this and in every heavy rainfall . . . there comes into play a very intensive

and sudden condensation : that a hailstorm is a real tempest in which precipitation takes place partly in the form of ice." Beginning from our present considerations, we reach the following conclusions : Hail represents a transition from the gaseous state through the liquid to the solid which occurs in the light-ether sphere of the earth organism. Hail is solidified, therefore, under the general laws of light ether, which produces triangular shapes. In fact this is visible in the shapes of hail stones, which can generally be recognized as variations of the forms in the following sketch.

Hail stones (after Professor Trabert)

Thus we see the triangle of light ether which it gives to substances " shooting into form " in the light-ether sphere.

In this phenomenon the earth organism demonstrates to us how the previously formless substance is seized suddenly by the shape-creating forces, the etheric formative forces, and how the newly shaped form is an expression of that etheric force in whose sphere and through whose co-operation the shape-creating occurs,

In the second cross-section, indeed, we have an illustration of two processes. The chemical ether, whose half-moon-shaping force when working from all sides equally, produces the sphere, has, through its suctional action from the centre upon the outer parts of the sphere, caused the condensation of the gaseous into the fluid by sucking together the substance (Chap. IV) ; in addition, during the hardening of the now fluid substance to solid, the light-ether sphere of the earth organism, in which the hardening to ice occurs, has imposed the triangular external forms.