petite by the proper touch in each exercise upon the historical bearings of the subject under discussion, whatever it might be,—an eponymic question asked, the original source-books passed around, a paragraph read, a picture shown or an incident related. In this way, by the process of repeated inoculations, many students who unquestionably would have sidestepped a formal course of lectures became unconsciously impregnated with something much more valuable to them in the long run than the acquirement of just a few more facts concerning diagnosis and treatment.

It will be apparent, I hope, from all that has gone before, what is the burden of my theme—a library made useful not as a passive but an active force; one that is "not vocational but cultural, not final but initiative"; one that will serve as a common meeting-ground where the different streams of knowledge may coalesce; one where an interest in the history of our great profession will so flourish as to permeate into all departments of a much-divided school; a place from which the appeal of scholarship free from pedantism will radiate to long generations of future students—a place, in short, where Medicine, the foster-mother of the sciences, once more in close contact with her whole family will imbue them all with the spirit of that ancient phrase, "Where there is love of humanity, there will be love of the profession."

As was true a quarter of a century ago, so is it no less true now that there is but one man who by universal accord has the qualities of a Conciliator needed to bring these possibilities to fruition—a man whose services to his profession and to this School are apotheosized by this building—a man who can see the reasons for things while most of us can but look for the things themselves, and who is aware "that as our own conquests could not have been won without those which our fathers won, so must the future forever rely for help upon the past."

He might have asked to be allowed to approach in quiet the evening of life, content with the many successful parts he has already played, but this was not his way. Few knew how he has laboured during the first sabbatical year he has ever taken, what hours he has spent in cramped, dark and unventilated places personally to select and bring together what are to be the tools of this new institute that bears his name, never a day without work, never a conversation without its direction on something that mattered. In accepting this new and important rôle he stands, to paraphrase some well-known lines, upon the summit of his years: Not bowed beneath their weight, with feet firm planted and soul undaunted, he stands and contemplates what time has wrought, and trembles not for what was, is, or is to be.

THE PLACE OF GEOLOGY AMONG THE SCIENCES[1]

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IN the early specialization of natural science it seemed relatively easy to give sharp definition to the boundaries of each subject. To-day, as we look upon the continuity of the universe in time and space and action the aspects of knowledge which we call the sciences represent in considerable measure only different points of view.

Seen as a part of the general scheme of things, each so-called science is the point of focus upon which other knowledge is concentrated for a particular purpose. Looking out from the place at which these rays converge it might appear that each subject comprises all the others. So physics may seem the whole of the universe, including life, mankind and human activities. Anthropology, described as man and his works, could compass everything from physics to religion.

Geology, as representing the earth, its structure, its activities, its history, touches science in all phases. It ranges through the physics and chemistry of the earth, its physico-astronomical origin, its expression of current activity, changes of form and face, history of climate and the biological story read from the geological record. Even our basis of judgment regarding the nature of man and his possibilities for the future is indissolubly bound in with the geological story. And yet geology is not all these subjects. It is only that aspect of each expressed in the composition, origin, structure, activities and history of a particular astronomical unit—the earth—upon which we happen to live.

Apart from the centering of attention upon this particular earth, geology possesses marked individuality as a mode of thought, or as the consideration of a special aspect of natural relations, through its expression of the element of time and the significance of movement through it. Lyell described geology as "the science which investigates the successive changes that have taken place in the organic and inorganic kingdoms of nature." It stands out clearly among the sciences as the symbol of time and development. In

[1] Read at the fiftieth anniversary celebration of the United States Geological Survey, Washington, D. C., March 21, 1929.

no other phase of knowledge is there a comparable record of events in their chronological order, laid together in such manner that the processes or movements may be made the subject of scientific analysis. In no other science is there comparable illustration of the processes of change or movement or evolution as related to or framed in time.

Important as the developmental or evolutional view has become in science, in general we interpret the materials most readily through the historical process. So in biological evolution the close resemblance in structure of certain birds and reptiles suggests common origin. One assumes a history which would carry the two branches back to remote time where common ancestors might be found. But geology, with its fourth dimension of time, shows us the succession of ages with actual materials left from each in the order of appearance. In ancient mud deposits of south Germany preserving with almost miraculous fidelity the intricate tracing of the insect's wing and the form of the jellyfish, the relationship of bird to reptile is made real by that strange creature, the Archaeopteryx, with long, feathered lizard tail, fingered wings and toothed reptilian jaws, a veritable missing link.

The historical element of geology corresponds to that of archeology in that it is of the order of inference which does not leave room for reasonable doubt. Fragmentary as the remains may be, they are the residuals of materials themselves, and the sequence in which they appear represents the measure of time and of change.

The results in use of this method of examination in terms of time are of incalculable significance to all science and to our thinking as it concerns human problems.

No discussion of structure or history of the earth approaches completeness unless there be included in it an acceptable statement of the origin of the planet in terms of cosmic physics. The attempt to trace the story back to its beginnings is not mere expression of idle curiosity. In the physics and astrophysics involved in the initial development of the earth lie important elements relating themselves directly to the processes and problems of geology as we meet them to-day. Basic in consideration of laws dominant in geological activity must always be that chapter in the story of the earth centering upon studies such as those of Chamberlin, indicating that our planet owes its origin to approach of another star, bringing about partial disruption of the sun and expulsion of a great mass which ultimately formed the earth. In many aspects this phase of geology is physics; in others it is astronomy.

Again, in the story of earth activities illustrated in crustal movement, or in what might be called the physiological process, the principles of physics expressed and interpreted through mathematics become so fully dominant that at times they seem in importance to overshadow the process considered in terms of geology. But we may not forget that even in these investigations the elements of time and sequence and the mode of change become dominant in the synthesis of data which furnishes the ultimate story of the earth.

In a long generation behind us the geological story of life has attained a relatively high level of human interest, suggesting as it does the principle of change or development or evolution through the ages. The nature of the movement, and the process as we see it, might have been worked out through examination of the expression of life in its many kinds or species, or the relation of this differentiation to distribution, or the differentiation and distribution as related to the embryological history of the individual. Yet, with all the data available, the most clearly indisputable evidence of the process which we call evolution is that presented by the record in the rocks.

The aid of geology to biology has been fully repaid by biology through its furnishing of the unreversed paleontological sequence which has been a critical factor in working out the geological time scale for the world. Geological and paleontological correlation, as means for furnishing a complete and fully interpretable record, still presents one of the most important problems of research.

Among the outstanding biological questions toward solution of which geology makes contribution are those concerning the origin and history of man. One of the most important ideas in the range of knowledge is the suggestion that through the ages human kind has tended definitely to widen its opportunity and increase its capacity for understanding. This principle in history so highly valued to-day is made possible largely through evidence from the geological record. One of the elements of especial interest in the geological story lies in the suggestion that of the total record of human life probably more than 99 per cent. comes well within the region for which the geologist is the accepted authority.

The place of research in this particular field of geological history may well rank among the leading possibilities of science. While the investigator rests with assurance upon evidence that to him seems adequate, the great bulk of data still to be expected from research would have enormous influence in making clear to all mankind the idea of change and progress in the longer stretch of history.

Considered from one point of view, we may think of the heritage of man as represented in three elements—the sun, the earth and our machinery for use and development of knowledge. The earth with its story is the objective of the geologist. Upon it must concentrate the most intense study that human intelligence can plan. By definition the geologist becomes conservator of great natural resources upon which life and the future of mankind will in large measure depend. Conservation is not *disuse*—but *which* use shall we permit. Within its program research may well come to have the highest place, with premium placed not alone on discovery of the situation in which a substance is found. The way to use the material to full advantage will also be recognized as of enormous human value.

Recently we began to discover that certain of our biological resources which might soon vanish may be replaced. The reproduction or the synthesis of that which forms the solid earth we have yet to learn. Geology must draw on all knowledge to build its broad foundation even wider. So chemistry and physics and geology will unite to locate and to devise the economic exploitation and the best human use of a wide range of substances of inestimable value to man. In another direction geology and agriculture see the study of erosion and sedimentation as an essential phase of research relating to future use of the arable lands of the world.

And, last of all, among the sciences geology bears responsibility as teacher in a field which is always spread before us in daily life. To some the earth's face never ceases to be flat, and so flat-minded they remain. To others the hills and valleys, through the story of history and building and beauty they present, open a vision of realities which lifts us far above the pettiness of things which in the routine of the day may tend to trouble us.

OBITUARY

TOSHIKI MORISHITA

ON July 2, 1929, occurred the death of Dr. T. Morishita, who for two and a half years had been connected with the Yale University department of bacteriology as an assistant and research student engaged in a study of dental bacteriology and pathology. He had been suffering for several weeks from a respiratory disturbance which did not appear serious and which until a few days before his death promised complete recovery.

Dr. Morishita was born in Japan in 1896. He obtained his early education in the Tono High School, and in 1914 entered Tokyo Dental College, from which he graduated in 1918. For several years after graduation he practiced dentistry in Japan. His yearning for scientific research related to problems of dental decay became a passion, and in 1922 he relinquished his profession and sailed for America to prepare himself further for scientific dental research. He entered the Toronto Dental College, receiving the degree of D.D.S. in due course.

After having engaged in special research work in McGill and Harvard Universities, where he further laid an excellent foundation for his work as an investigator, he became intimately associated with the division of general bacteriology of Yale University, where for over two years he prosecuted his research feverishly and without serious interruption until his untimely death.

Dr. Morishita's chief interest was centered in natural dental decay, and more particularly the influence of high acid producing and tolerating (aciduric) organisms which he found to be so intimately connected with initial and progressive caries. The first report of this painstaking work appeared in the *Journal of Bacteriology* for September, 1929. It was the author's intention to follow this paper with four or five contributions, for which sufficient data were rapidly accumulating. These records are now in the possession of the laboratory, and it is hoped that they may be built up into at least one or two additional manuscripts and published under Dr. Morishita's name.

Dr. Morishita was particularly well qualified as an investigator in the field of scientific dental research. He was brilliant in the conception and execution of his complex problem. He was ceaseless in his devotion to his work, and had attained a degree of success in his chosen field which promised a bright future.

LEO F. RETTGER

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RECENT DEATHS

DR. EDWIN W. ALLEN, chief of the office of experimental stations of the U. S. Department of Agriculture, died from heart disease on November 11. Dr. Allen was in Chicago to attend the meeting of the Association of Land Grant Colleges and Universities. He was to have given a memorial address on his predecessor, the late Dr. Alfred C. True. Dr. Allen, who was born in 1864, entered the service of the Department of Agriculture in 1890 and was assistant director of the office of experiment stations from 1893 to 1915, when he became chief of the office.