

ELEMENTARY LESSONS  
IN  
PHYSICAL GEOGRAPHY

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BY  
SIR ARCHIBALD GEIKIE, K.C.B.

D.C.L. OXF. ; D.SC. CAMB., DUBL. ; LL.D. EDIN., GLASG., ST. AND., ABERD. ;  
PH.D. LEIP., UPSAL. ; PRES. R.S.

*Corr. Inst. France ; Acad. Berlin, Vienna, St. Petersburg, Rome, Naples,  
Turin, Munich, Göttingen, Stockholm, Christiania, Belgium,  
Philadelphia, Boston, Nat. Acad. Washington, etc. ;  
Late Director-General of the Geological Survey of  
Great Britain and Ireland*

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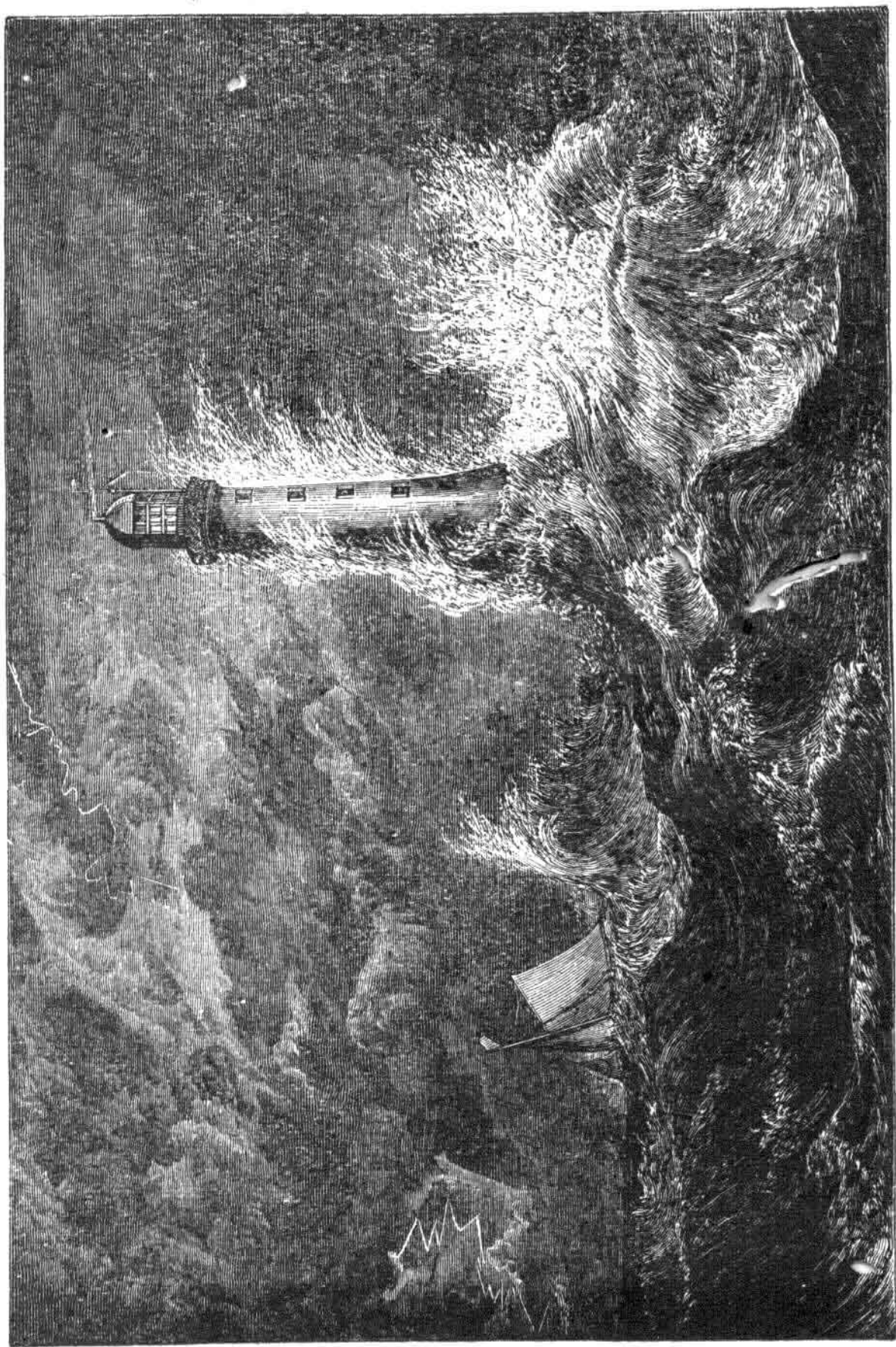
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OCEAN-WAVES. (*After J. M. W. Turner.*)

## PREFACE.

A SIMPLE but systematic and yet interesting description of the familiar features of the Earth's surface may be regarded as a natural introduction to the teaching of science. Treated from this point of view, Physical Geography may be made a valuable instrument of education. To give it such importance, the most advantageous method is to make use of the common knowledge and experience of the pupils, and, starting from this groundwork, to train them in habits of observation and in scientific modes of thought and inquiry among every-day phenomena. From the very outset the instruction should be as far as possible practical. A shower of rain, the growth and disappearance of a cloud, the flow of a brook, the muddy water of a river, the shape of a cliff, the outlines of a mountain, the undulations of a plain—these and the thousand other common features of landscape should be eagerly seized by the teacher and used as vivid illustrations of the broad fundamental principles which it will be his main object that his



pupils should thoroughly master. Thus employed, Physical Geography is not learnt as an ordinary task, but rather becomes a delightful recreation, in which, however, the observing faculty is exercised, the power of induction cultivated, and the imagination kept constantly active.

Having been long convinced that such a method of instruction would place this branch of science upon a firmer and broader footing in our educational system, and would moreover prove of great service in fostering a spirit of observation and reflection even among children, I projected many years ago the *Primer of Physical Geography*, published in the series of *Science Primers*. The continued sale of large impressions of that little work encourages the hope that the method advocated has been found successful in practice.

The present volume is a further development of the same plan of instruction. As its title implies, it still deals mainly with the broad elementary questions of Physical Geography. It would have been impossible to find a place within its Lessons for the treatment of every branch of the wide subject, and as impossible, had it even been desirable, to bestow equal fulness upon every branch for which room has been made. I have devoted most space to

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those aspects of the science which, in my own experience, have been found best suited for practical instruction. While as much general information as may be feasible should be communicated to them, young pupils cannot of course be expected to find the same interest in all divisions of the subject. It is of far more consequence to awaken in them a taste for such pursuits, and lead them to carry on the study of their own accord, than to try to charge their memories with dry facts and figures which, in the absence of intelligent and suggestive teaching, are too commonly meaningless and repulsive.

While, therefore, adhering to a systematic treatment, I have been led to dwell, for example, on the phenomena of the atmosphere at much greater length than is usual in elementary class-books. These phenomena are among the most familiar and universal features of the globe; examples of them can be constantly adduced, and they may thus be used with singular advantage to illustrate how the facts of science are observed and its laws are deduced.

I acknowledge with pleasure my obligations to my friend Mr. Buchan, who not only kindly allowed me to make use of his Charts of Atmospheric Pressure

and Temperature, but who also read over the proof-sheets of the first two chapters and gave me valuable suggestions on subjects regarding which he is so high an authority.

In this fourth Edition the text has again been carefully revised. Although the elementary facts and leading principles of Physical Geography are now, on the whole, so well settled that comparatively little change is needful in successive impressions of such a work as the present, additions to our knowledge of the earth are continually being made which from time to time call for a reconsideration of conclusions that had seemed definitely established. The Plates, which were redrawn for the last Edition by Mr. Bartholomew, have again been subjected to his revision. It is hoped that this little volume will thus be found to have been brought abreast of the present condition of science, and that it may continue to receive the favour which it has enjoyed for so many years.

*December 1911.*



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# ELEMENTARY LESSONS IN PHYSICAL GEOGRAPHY.

## INTRODUCTION.

1. At night, when the sky is clear, the largest stars seem to stand out in front, with others less in size and brightness crowding behind them. As we gaze into these depths, still remoter and feebler twinkling points appear, until at last our eyes can no longer shape out any distinct specks of light. Such a sight impresses our minds, as nothing else can do so vividly, with the vastness of the Universe. We feel how comparatively small must, after all, be the distance which we can see into that "star-dust" which has been sown through the regions of space. And even when, with the aid of a good telescope, we return to these same skies, it is to find more cause than ever to acknowledge how immeasurably vast is that part of the Universe which man can thus explore; but at the same time, to meet again with a vague limit, beyond which we cannot see, not because we have reached the utmost verge of creation, but because our instruments can carry our vision no farther. Far beyond that limit, it may be that the regions of space contain other stars and systems, though too remote ever to be brought into

view even by the most powerful telescopes which human skill could construct.

Astronomers have calculated the distance of some of the largest and nearest stars. But their figures, expressing sums of many millions of miles, are too vast to carry any definite ideas to our minds. When we reflect that each of those stars, from the brightest to the faintest twinkling point, is really a sun, many of them, no doubt, far vaster in size than our sun, but dwindled into such seeming feebleness by reason of their inconceivable distance, we cannot but feel what a little speck of dust, in comparison, must this dwelling-place of ours really be which we call the Earth.

2. It is useful to get this comparative insignificance of the Earth firmly realised by our minds. And in no way can this be done so well as by watching the starry sky, and learning what has been discovered regarding the motions, sizes, and distances of the heavenly bodies. What, then, is the Earth in relation to these bodies? Has it always been in the same condition as now, or has it perhaps passed through long ages of change and progress? Mankind has had a long and varied history. May not the Earth itself have had one also? If so, can we learn anything about the story of the Earth?

3. Again, when, on the other hand, we look upon the face of the Earth by day, how boundless and varied it seems! From the district in which we may chance to live, we can pass in thought to the country at large, then to other countries, and then to the idea of the whole wide globe, with its continents and oceans, its mountains, valleys, and plains, and all that wonderful diversity of form and colour which makes its surface so unceasingly beautiful.

4. This variety is everywhere associated with life and movement. Consider, for instance, the unvarying succession of day and night; the orderly march of the seasons; the constant or fitful blowing of the winds; the

regular circling of the ocean tides ; the ceaseless flow of rivers ; the manifold growth and activity of plant and animal life ! Surely it was no strange thought when men in old times pictured this world as a living being. And even though we cannot look on the earth as a living thing in the sense in which a plant or animal is so called, yet in view of all that multitudinous movement which is ever in progress upon its surface, and on which, indeed, we know that our own existence depends, there is evidently another sense in which we may speak of the life of the Earth.

5. Now this Life of the Earth is the central thought which runs through all that branch of science termed Physical Geography.<sup>1</sup> The word geography, as ordinarily used, means a description of the surface of the earth, including its natural sub-divisions, such as continents and oceans, together with its artificial or political sub-divisions, such as countries and kingdoms. But Physical Geography is not a mere description of the parts of the earth. It takes little heed of the political boundaries except in so far as they mark the limits of different races of men. Nor does it confine itself to a mere enumeration of the different features of the surface. It tries to gather together what is known regarding the Earth as a heavenly body, its constitution, and probable history. In describing the parts of the earth—air, land, and sea—it ever seeks so to place them before our minds as to make us realise, not only what they are in themselves, but how they affect each other, and what part each plays in the general system of our globe. Thus Physical Geography endeavours to present a vivid picture of the mechanism of that wonderfully complex and harmonious world in which we live.

6. Many of the facts with which this branch of science deals are familiar to every one. With nothing, for exam-

<sup>1</sup> This term as here used is synonymous with Physiography, which has been proposed in its stead.

ple, have we better acquaintance than with the air which surrounds us. We have breathed it every moment of our lives ; we know it at rest as well as in storms ; we have watched the growth in it of mists and clouds, as well as the fall of dew and rain. At first there might seem hardly anything more perfectly known to us, and therefore regarding which we should have so little new to learn. But Physical Geography, taking up the subject as one great whole, strives to show how all the different conditions and changes of the air are connected together, to explain their causes, and to point out the essential part which the air takes in the great movements that affect both sea and land. One of the chief advantages of this study lies in the very commonplace character of the phenomena of which it treats. We cannot go anywhere without meeting with illustrations of some of the great lessons which it enforces. When we have once practically learnt these lessons, therefore, we carry an additional source of pleasure in every walk and journey. We get into the habit of using our eyes, and noting an endless variety of things that would otherwise have been passed by unseen, and this habit of observation, besides the pleasure its exercise brings with it, will be found of no slight service in the ordinary affairs of life.

7. In completing its picture of the Life of the Earth, Physical Geography must necessarily draw its illustrations from all parts of the world. It thus brings before us phenomena of which we may have no experience in our own country, and which, very probably, we may never have any opportunity of seeing for ourselves. In the study of it we journey, so to speak, all over the world, and learn in a short time far more about the world than we should be able to do from reading a few ordinary books of travel. Indeed, a good treatise on Physical Geography may be regarded as a condensed and well-arranged book of travels in all countries, with this dis-



tion, that although it has no personal adventures to describe, it enables us to understand how one region of the earth differs from another, and it explains these differences by connecting them all together and showing their relation to the general principles or laws on which they depend. So that, although a man may never have been in India or Africa, or the Arctic regions, he may, from the study of Physical Geography, have a far better notion of the general features of these countries, and why they differ from each other so much in climate, than many other men who have travelled to, or even have lived for years in them. It is a matter of no little encouragement for all of us to know that the more we watch what takes place around us in our own country, and the more thoroughly we understand it, the more easily do we realise what goes on in other and distant parts of the world.

8. By taking up the study of Physical Geography, not merely as a subject to be learnt from books, but as a practical pursuit to be followed out by our own observation, as opportunity offers in the course of our daily occupations, we make most progress in it and get the largest amount of pleasure out of it. This is the spirit in which the following chapters are written. They are not meant merely to describe the different parts of the earth in such a way that these may most easily be learnt by heart, but rather to incite the learner to use his own eyes, and to examine, compare, and contrast what he sees to take place from day to day. They are so arranged as to begin, where practicable in each sub-division, with our common knowledge. Then they point out what can be ascertained on the subject by our own simple observation and experiment. Lastly, they present such further information as may be acquired from the observations and travels of men who have given much time and thought to the collection and investigation of the facts. In the case of the Air, for example, starting from what each one of us knows by everyday experience, we proceed to con-

sider what we can ourselves easily find out about the air, and from this basis of knowledge we follow what has been still further discovered by prolonged investigation in all parts of the world.

9. At the outset it may be well to group together in due order the different subjects which, coming within the scope of Physical Geography, will have to be attended to in these Lessons.

10. First of all we shall consider what the Earth is, as a heavenly body, how it is related to other heavenly bodies, and specially to the Sun, as the source of light and heat.

11. Secondly, looking at the Earth in itself, we find it wrapped round with an outer envelope of Air, which will next deserve our attention. What this envelope consists of, and the part it takes in the phenomena of the Earth's surface, furnish materials for much interesting inquiry.

12. Thirdly, beneath the surrounding shell of air, and covering the greater part of the surface of the solid globe, lies that vast expanse of water known as the Ocean. We shall follow its tides and currents, and trace the vapour which, ascending from its surface, is carried through the air until it falls as rain and snow upon the land, whence it is borne by rivers back again into the ocean. The wonderful beauty and high importance of this circulation will claim our attention.

13. Fourthly, the solid Land will be considered, with its continents and islands, its mountains and valleys, its earthquakes and volcanoes. The evidences of continual change on the surface of the land will lead us back to the action of the air and of water, and we shall find how largely the forms even of "the everlasting hills" have been determined by that action.

14. Fifthly, we shall inquire what Climate is, how different kinds of climate are distributed over the globe, and whether any causes can be assigned to account for

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such differences. This will lead us to note that as there is a geographical distribution of climates, so likewise is there one of plants and animals. Each great region of the earth's surface which has a peculiar climate of its own, has also its own distinguishing assemblage of peculiar plants and animals. Even in the way in which the races of man are grouped over the earth there is evidence of the same connection between the distribution of climates and of life. Thus the geographical distribution of Life over the earth's surface will form the concluding part of these Lessons.