

PROCESS AND FEATURE IN THE TEACHING OF PHYSICAL GEOGRAPHY.

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When physical geography was rescued some years ago from the boneyard of the dead languages, it was given a new name and a new place in the realm of knowledge and the world of education. This resurrection and ascension of physical geography to a place among the gods of science was accomplished by introducing into the subject the causal notion or explanatory idea.

Now what do we mean by cause and effect and the explanatory idea anyway, and what is there in it that has such life-giving and resurrectionary powers? When we follow a chain of causes back and back until the inquisitive mind ceases to ask why and is satisfied, or until it finds no answer to its further questionings, and then go in review over the impress and effect of such an inquiry on the mind, we shall generally find recorded there the memory of a succession of events. This succession of events as thus held in mind consists, in the case of most phenomena of the physical world, of two sorts of ideas. On the one hand we have the concepts of a variety of material things, on the other of these same material things in motion. These motions of material things succeed each other in time and leave imprinted upon our minds the memories of a succession of phenomena which for purposes of this discussion we may call a series of events.

The memory of this series of events which leads from one observed phenomenon or thing which we call a cause to some other phenomenon or thing which follows it in point of time and which we call an effect—constitutes for most of us our sole notion and idea of causation. When a certain event or phenomenon always and invariably follows a given preceding event we come after a number of repetitions, to look upon one as effect and the other as cause. We have come to believe that lightning causes thunder because the lightning always precedes and the thunder follows. When we attempt to explain the thunder we introduce between the observed flash of lightning and the heard clap of thunder a series of unheard and unobserved events which connect the two. The world did not know the cause of the spread of yellow fever because it did not know the series of events which connected

the spread of that disease with the mosquito. To introduce and discover this series of unheard and unobserved events between various causes and their respective effects is the business of modern science.

But this succession of events in time is also process, and cause and effect are thus inseparably connected with process. When we describe a process we simply state the series of events of which it consists, and when we know and understand this series of events, we know the cause or causes which produced the given thing or phenomenon.

If I am correct in my first statement that it was the introduction of the causal notion that transformed the old physical geography into the modern physiography, and in my second that the causal idea arises from the knowing of a series of events which connect any given so-called cause with its consequent effect, and in my third that this series of events is also a process, then I am right in my conclusion which I now draw that it was the introduction of process into physical geography that rejuvenated it.

Whatever be the relation of process to feature in the teaching of physiography, whenever process does enter as an explanation of feature, there are at least two errors to be guarded against in giving any process or explanation. The first of these is that every step in the process, every event in the series, must be stated or understood, and none omitted or left out. If the complete process with every step, every event stated, is too difficult, then omit the explanation entirely, for there is nothing surer in this world than that if an entire series of causally connected events is too difficult to be understood when all are stated, it does not simplify the matter any by omitting one, two or three events in the series, and yet that was just the inheritance that we received from the old geography when it attempted explanations. Take, for example, the old explanation for convectional circulation of air, due to unequal heating, as we used to commit it to memory, and as it is still taught widely in the grades.

1st event. The air becomes heated—poor statement,

2d event. is made lighter—three events omitted,

3d event. and rises—two more events left out,

4th event. and the cold air comes in to fill its place—event not in its sequential order.

Is it any wonder we never understood convection when a process consisting of eight events is reduced to four? Is it to be wondered at that we committed these four to memory as the only

thing to be done, and glibly repeated them when the teacher pressed the button?

Explanation of this kind is perfectly deadening in its effect upon students. It not only prevents mental growth, but it blasts and withers, because thinking they know when they know not, all desire to know is killed.

A second mistake that we often make in teaching an explanation or a process, but more frequently in calling for explanations from our students, is the giving or the receiving from them the name of the cause instead of giving or requiring a statement of how the cause causes. Thus, if I ask a student this question, "Why?"—and why means explain why—"do the trade winds in the Northern hemisphere come from the Northeast?" or this: "Why do cyclonic storms whirl from right to left in the Northern hemisphere?" and he answers, "Because of the rotation of the earth," I am doing him a permanent injury if I accept his answer and thus permit a "why question" to be answered by a "what answer." Thinking, and, therefore, the discipline of physiography or geography arises from the tracing of a series of events from any given feature or phenomenon back to their causes and forward to their effects. If we allow some of the events in the series to be omitted, or the whole series to be skipped, and only the first cause or the final effect to be stated when asking for the whole series or the complete explanation, we are robbing physiography of its greatest disciplinary and educational value.

Physiography consists of or deals with two manifestations of Nature—material things or physical features and these material things in motion or process. Feature and process can never be disconnected or separated. Process implies motion and activity, but motion and activity are unthinkable without some *thing* that is moving. We begin with a thing, a something in motion. This motion is imparted to other things and a chain of causation, a series of events, is started which finally produces some great physical feature of the earth, a mountain, a wind, a flowing stream. These great features in turn set up various activities which manifest themselves in life. These physical features of the earth, how they were caused, and how they influence human and other life, constitute the province of physiography.

How shall we proceed in teaching the subject? Shall we begin with feature describing, picturing, illustrating, tracing out human consequences, and then, when the given feature is clearly

understood, explain it or give the process by which it was produced? Or shall we proceed more deductively, beginning with some preceding cause and following out the process or series of events which produced the given feature?

A study of existing text-books of physiography shows us that the authors of these texts may be divided into two classes, according to the way in which they have answered these questions in writing their books. The method of approach and the emphasis placed upon process or feature by these various authors depends upon whether their point of view be that of geology or geography. The geographer is interested primarily in feature because it conditions and influences life. The geologist is interested in process. He studies existing and present features because they contain a record of certain past processes. His business as a geologist is to write the story of past events and processes. The one takes feature as a cause, and looks forward to its effects upon life; the other takes feature as an effect, and looks backward to the processes which caused it. Geography and geology stand in part upon common ground, but they stand back to back and face in opposite directions.

The point of view of physiography or physical geography is geographic, and its interest lies in features and their effect upon life, but these "features must not only be described, they must be explained so that the understanding shall aid the memory in holding them in mind." Shall we begin with process and lead up to feature, or shall we begin with feature and work back through process?

At this point I turned to two modern text-books. The first 188 pages of one book is called "General Physiographic Processes," and deals with such topics as changes in surface and climate, warfare of forces, rising and sinking of the land, wrinkling and folding of the crust, denudation, work of running water, wave erosion, etc., etc. This is followed by part II, where the results of the preceding forces are discussed under such heads as marine plains, lake plains, plains of erosion, volcanic plains, mountains of erosion, mountains of folding, mountains by faulting, etc., etc., with the emphasis ever upon the process concerned.

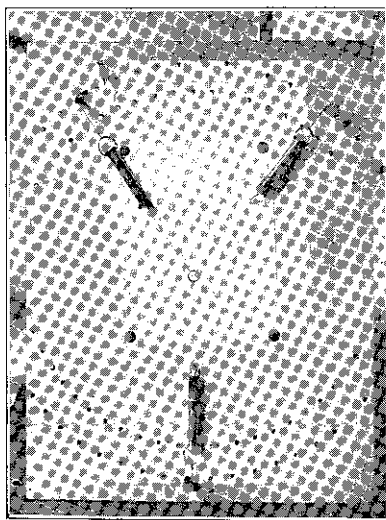
Nowhere in the other book is there a single chapter dealing with process. Here and there are brief paragraphs and sentences, but process is subordinated, and feature and the relation of feature to human life are the striking characteristics of

the book. When a given feature has been covered, enough of explanation has been woven into the description so that one understands how it was produced. This book gives one an interest in and a feeling for feature and region. The other book arouses interest in the great processes and forces of nature. Is this merely a peculiarity of these two books, or is it inevitable when the subject is presented, after the manner of either of these books? Which, or what, should be the point of view of physiography? Which method of approach is along the lines of least resistance, and at the same time accomplishes the end in view?

APPARATUS FOR CONCURRING FORCES.

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The accompanying picture illustrates a piece of apparatus of my own constructing for demonstrating concurring forces. It



consists of a drawing board of soft wood, three spring balances, three violin pegs, and four thumb tacks. In the board are drilled two circles of holes the size of the violin pegs. To a small metal ring are attached three fine steel wires, the other ends of which are fastened to the hooks of the balances. The rings of these balances are fastened to wires that are run through the pegs.

By placing these pegs in the proper holes and turning, the desired tension is obtained and maintained as long as desired.

The rest of the experiment is the same as outlined in any good manual.

The violin pegs do away with the clumsy clamps that we have heretofore used. The two circles of holes make it possible to choose any angle.

The whole thing is so simple, works so easily, and gives such good results that I am more than pleased with it.