Comments and Communications

Areal Differentiation and the "Science" of Geography

SOME professional geographers hold the essence of geography to be areal differentiation. This concept presumably involves a description of the respective regions or areas of the earth and, possibly, an interpretation of the observed differences. We challenge the point of view as untenable if it is not based upon certain fundamental and established principles, which may be utilized as standards of reference. Few would quarrel with the presumption that a function of the geographer is to observe and to describe the characteristics of different (natural and cultural) landscapes. For convenience in accomplishing this purpose it is his privilege to divide the earth's surface into limited areas or regions. If, however, he merely concentrates upon pointing out differences among the landscapes he has described, he will not advance his science very far, if at all. In fact, if this is all he does, the geographer has little right to refer to his field as a science.

If a science consists of the knowledge of principles, laws, and general truths, as authoritative interpreters and historians of science assert, then a study limited to the differentiation of areas will not permit the inclusion of geography in the category of science. Principles, laws, or general truths cannot be derived from a mere comparison of differences. Before their significance can be determined, a standard of reference must be established. Circumstances may differ from each other, and each set of differences may have its own explanation, but only when these differences have a common cause can there be a scientific generalization or interpretation. If science be defined merely as a branch of systematized knowledge, then any branch of learning is a science, in which case geography would be so identified. But this is a point of view to which we cannot subscribe.

In contrast with the consideration of geography in terms of areal differentiation, we wish to emphasize the point of view of Ritter, who suggests a comparative approach in which similarities are emphasized. The few geographers who have engaged in microregional investigations have made an excellent beginning in the Ritterian approach. A vast number of such studies needs to be made. If we can find enough cases over the earth's surface to demonstrate that life will always respond in the same manner to certain circumstances, or that landforms will always evolve according to a given order, or that atmospheric behavior will always be the same under given sets of conditions, then we shall have discovered laws or general truths, on the basis of which we may make predictions. Only then shall we have established geography as a science.

Geographers borrow from many fields, but to what purpose? Is their purpose merely to correlate those elements which together constitute a landscape,[1] to describe the landscape, or to differentiate it from another area? We are reminded of a question often propounded by the late O. E. Baker to aspiring students writing theses: "What is there in your description that a good journalist could not have done as well or even better than you?" If the function of the geographer is merely to describe and differentiate, he contributes little or nothing that is unique. Such an effort does not necessarily require a formal geographic training. The same end might be achieved by one who combines skill both in observing and in using language. If geography includes, in addition to areal differentiation, an interpretation of differences, as some do concede, then it begins to take on significance. But somewhere there must still be established a standard of reference against which interpretations of differences may be checked and tested for their validity.

We recognize the difficulties that confront the geographer when he seeks to discover general truths or principles concerning mankind in relation to the physical earth, in contrast with the physicist or the chemist, who can make determinations in a laboratory where he can set up controls as standards of reference, and where he can examine performances at will under easily regulated conditions. Man, possibly the most complex of all variables, cannot be harnessed to make possible a repetition of a given behavior in the presence of a prescribed set of conditions. Not only is he himself a variable reflecting both inherited characteristics and sensitivity to environmental adjustments, but his natural environment is a variable, perhaps never being exactly reproducible. We need not completely despair. A given set of natural conditions can be approximated on different parts of the earth's surface with sufficient frequency to yield a pattern which for all practical purposes can be interpreted as a standard of reference. Studies of man's behavior in the setting of that pattern, appropriately compared, offer us some hope of deriving a correlation that may lead to a principle or law. Not until investigations are carried on with the purpose of uncovering a series of identical situations can we stabilize the field of geography and make it truly useful. From the accumulation of a vast number of observations in which similar conditions occur, we may be able to generalize and establish standards of reference. Then, wherever we find departures from the standard, we may be able to interpret them, confident of the validity of our conclusions.

We desire to stress the difference between the philosophies of areal differentiation and of the comparative method for purposes of discovering similarities.

[1] We use the word "landscape" in an all-inclusive sense—all the elements, organic and inorganic, within a circumscribed or delineated area.

Again referring to Ritter's methodology, we may note that he compiled abundant data by means of systematic studies of regions, compared the findings, and sought to derive principles. Even though he did not attain great success in this effort, his approach was nonetheless in the right direction. To illustrate our point with a case from the plant world, let us suppose that we have observed a species of plant growing under a given combination of soil, drainage, and microclimatic conditions. Suppose we then map the distribution of the species and note that the physical environment is essentially the same, rarely revealing an exception. Looking over the results of this investigation and noting the similarities, we would feel quite safe in making some generalization with reference to the habitat of the plant and its behavior in a given environment. We could even go so far as to predict where such a plant species may be expected. In contrast, if we had merely observed that this species does not grow where another does grow, or had observed that the conditions under which it grows differ from those under which other species thrive, we could not have determined the optimum conditions for any species, nor derived any guiding principles.

The comparative principle involving the accumulation of many repetitive cases is the same whether we consider plants, lower animals, man, or even physical phenomena such as landforms. Suppose we observe areas A and B, noting that in A, manufactural activities are dominant, whereas in B agricultural occupations attract most of the population.[2] Under the program of areal differentiation our first function would be to describe what takes place in each area. In describing the landscapes we would have made a contribution to the realm of geography, since description is a legitimate and necessary phase of the field. If next we sought to find out why the uses of the lands differed, we might have learned that the reasons were to be found in economic, environmental, physical, or still other circumstances. Then what? Would we have been able to conclude that because of these differences certain reactions would always be true? Suppose we had compared area A with areas C, D, E, F, and many more, always finding that there were differences. Would these comparisons ultimately have brought to light criteria that would enable us to predict the circumstances under which a given area would become dominantly manufactural, agricultural, or something else? Would such observations have revealed the limiting elements with respect to the uses man could make of any area? On the other hand, had we made a systematic study of A and of all other manufacturing areas, seeking to find elements in common, or had we made a systematic study of a given set of physical conditions that would permit man to do any one of a variety of things and had followed this with a study of all such areas on the earth to see whether man reacted in the same way everywhere, then we should have set the stage for the possibility, at least, of discovering some principles. Our approach would have been positive. It seems to us that only through this approach—that is, description, analysis, and comparison of like areas—can we hope ultimately to derive standards of reference and to place the field of geography upon a firm scientific foundation.

[2] Although we have been emphasizing here the human relations aspect of geography, we do not subscribe to the notion that there is no geography where there is no human occupance. The field of geography is more inclusive than mere human ecology.

EUGENE VAN CLEEF

Department of Geography
The Ohio State University

Cloudiness in Relation to Choice of Astronomical Sites

THE article "Optimum Location of a Photoelectric Observatory," by John B. Irwin (SCIENCE, **115**, 223), represents a gratifying application of climatological data to a specific practical problem. There is, however, an unfortunate characteristic of the basic data that partially vitiates the conclusions drawn. As an astronomer, Irwin is interested in cloudiness at night, but the basic means of detecting clouds, the human eye and the sunshine recorder, are both most effective during the day. In addition, there are good physical reasons for believing that the spatial distribution of daytime cloudiness may be quite different from that of nocturnal cloudiness.

Daytime clouds tend to be of the cumulus variety and are often caused by solar heating of relatively moist air near the ground. These clouds are at a minimum near Yuma, Ariz., as Irwin points out, and this is due to the pronounced dryness of this region and the prevailing subsidence in about the lowest half of the atmosphere. Nighttime clouds tend to be of the stratiform variety and are usually due to large weather systems, such as frontal storms and cyclonic circulations aloft. The higher nocturnal clouds, at least, should then be relatively independent of the low level factors that produce the minimum of cloudiness near Yuma. One would then expect, for example, that cirrus, Irwin's "photoelectric poison," would not exhibit the same pronounced minimum of occurrence over Yuma that daytime cumulus shows.

Irwin concludes that the region within 40–48 miles of Yuma is far superior for photoelectric photometry of stars to any other region in the United States. It is my feeling that this is too restrictive a conclusion. I would hazard the guess that, if the proper *nocturnal* data were to become available, the entire southwestern United States, including southern California, all of Arizona, New Mexico, and western Texas, would be found about equally suitable. Unfortunately, reliable data on nocturnal cloudiness are almost nonexistent. A major factor in this deficiency is the difficulty of detecting thin cirrus at night.

In the absence of appropriate nocturnal data, I suggest that the apparent superiority of the Yuma region be discounted, and plans for a photoelectric observatory be broadened to include the above-mentioned states. Certainly one should not forego such practical