II. PHYSIOGRAPHY IN RELATION TO PAST CLIMATES

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In the Journal of Geology Volume 16, page 166, "Barrell says, "Topography and climate not only have independent and sometimes similar effects on the sediments but have mutual effects on each other. On the one hand topography in its major features modifies climate, on the other, climate naturally affects the minor features of topography." The effect of climate on topography is recognized generally by geologists and geographers but hardly to the extent it deserves the exception of the case of glaciation. Climatologists in turn readily recognize the effect of topography on the present climates. However, the author finds that neither climatologists nor geologists have sufficiently recognized how they might be of mutual help in the study and interpretation of the physiography and climates of the past. With the climatologists this may be because their efforts have been mostly confined thus far to the description and interpretation of the present climates and those of the recent past, while they have left to the geologist the study of the climates of the geologic past. The geologist on his part does not seem to have made as much use as he might of the intimate mutual relationship existing between the topography and the climates of geologic times. Certainly the physiography of the past is the geology of today and the physiography of today in the geology of the future; and if, as Barrell says, a mutual and close relationship exists between present climates and topographhy then that relationship has existed in the past. Consequently a study of it should help in the interpretation of geology.

Because of lack of knowledge until the present time the climatic regions and the maps showing distribution of land and water and the physiography of geological times are quite generalized. As the detailed knowledge of the history of the earth increases, and we come to know certain areas to have been cold or warm ,wet or dry, the climatologist's expert knowledge of climatic controls should be of great assistance in explaining certain apparent contradictions and anomalies and also in indicating what possible conditions of topography might be reasonable or unreasonable under the circumstances. Perhaps a few illustrations from both present and past times will make this clear.

1. The Great Basin has an arid or semi-arid climate chiefly because the mountains to the west act as a barrier to shut off

the rainfall from the Pacific Ocean. The geologists 25 million years from now may examine the sediments at present being deposited in the Great Basin, and knowing something of the location of the Pacific shore line at the present time they may be justified in citing the aridity of the Great Basin as one evidence of high mountains having existed along the Pacific Coast.

2. If a high range of mountains at the present time ran from West Texas to Georgia, the regions of the Mississippi Valley would be much colder than they are now with an arid or semi-arid climate and the region would possess quite different physiographic features from those of the present. It is quite possible that conditions somewhat resembling this may have occured during the late Silurian when the salt and gypsum beds south and east of the Great Lakes were laid down. With the Arbuckle and Wichita Mountains having a considerable elevation, the recently discovered Nehama Mountains of Kansas extending north toward Canada, and the Gulf of Mexico somewhat restricted in area, conditions would have been favorable for aridity in the region of the Salina beds and in turn the aridity of this region might justifiably be given as pointing to the former existence of high mountains not far to the west.

3. The red beds of Oklahoma and Texas were laid down under arid conditions as indicated by the salt and gypsum beds. We might infer from this the former existence of high mountains to the west, shutting off the moisture from the Pacific; and to the south either an absence of the Gulf of Mexico or the existence o a high mountain range shutting off the moisture from that direction, or if the region bordered on the west by the ocean waters those seas must have been very cold just as they are at present along the deserts of the west coast of South America.

I suspect that a more thorough study of the principles of climatic control might tend to reduce somewhat the inclination of some geologists to refer climatic changes to such doubtful causes as shifting of the poles or a drifting of the continental platforms. For example at first thought it seems very strange and unusual that warm temperate floras should have existed in the Arctic regions during the Miocene period, yet is is not much more astonishing than that the average January temperature of Iceland and of the west side of British Columbia and Alaska at the present time should be the same as that of Central Oklahoma. Yet we explain this fact rather easily by a consideration of the ordinary climatic controls.

To summarize: there is a close mutual relationship between

topography and climate. As the detailed topography and climate of the past becomes better known each should be an aid to the other. The climatologist by his specialized knowledge of the effect of climatic controls may be of considerable help to the geologist. As the laws of climatic control operating at the present time and the possibilities of their application to past conditions becomes better understood by the geologists it will probably be found that many cases that now seem extraordinary in the climates of the past may be explained by their help rather than, as has sometimes been the case in the past, by appeal to unusual and perhaps somewhat fantastic hypotheses.