MILEY'S PROCESS OF COLOR PHOTOGRAPHY.

FOR two years or so Mr. Miley, a photographer of Lexington, Va., has been using a process of color photography which seems to present distinct advantages over any process heretofore devised, and which promises to make color photography a complete success. Mr. Miley is a skilled photographer, and has spent much of his time in experimentation, often with no little success. His process of color photography is the outcome of some of these experiments, and can not be considered as a development of any of the other processes in use, none of which has such practical possibilities. Mr. Miley has made and sold many of these color photographs during the past two years, while he has, at the same time, been experimenting to improve the process. It is only recently that he has been prevailed upon to take out patents. A paper on Mr. Miley's work was read before the Chemical Section at the recent meeting of the American Association in Washington by Professor W. G. Brown, and specimens of the work in its various stages were exhibited, and I am permitted to give a description of his process to the readers of SCIENCE.

Negatives are prepared by the tri-color process, using three sensitized plates and three screens, red, green and violet, respectively. For the red screen an orthochromatic plate, flowed with a cyanin solution, is used; for the green screen an orthochromatic plate, and for the violet screen a plain gelatine bromid plate. There are thus obtained three negatives, varying in density in the different areas according to the color values of the three primary colors in the corresponding areas of the object taken.

Prints are made from these negatives by the use of bichromatized gelatine pigment paper (carbon tissue). The pigment papers used are red, yellow and blue. The blue paper is printed from the red screen negative, the red paper from the green screen negative, and the yellow paper from the violet screen negative. These three printed films are then superposed upon transfer paper, the result being a color photograph, imitating the colors of the object with a marvelous degree of fidelity. This process has been used to copy oil paintings, which will probably in the future be its greatest value, as well as to reproduce flowers and fruit in their natural colors. To obtain most accurate results great care and much experience are necessary. In Mr. Miley's hands the process seems exceedingly simple. The points along which experience is most necessary, and along which also improvements may be made, seem to be the following: choice of screens so as to give the full color value of the object; corresponding choice of pigment papers to match the effects of the screens; choice in time of exposure through the different screens, so as to attain the true color value of the object; density of printing films; order of superposition of films.

While great improvements will be made in the future, the process itself can no longer be considered in its experimental stage, as it has now been in commercial use for upwards of two years. It constitutes one of the greatest advances in the history of photography.

JAS. LEWIS HOWE.

CURRENT NOTES ON PHYSIOGRAPHY.

PHYSIOGRAPHIC DIVISIONS OF KANSAS.

AN essay by G. I. Adams under the above title indicates the salient characteristics of several natural areas, and illustrates their boundaries on a map (*Bull. Amer. Geogr. Soc.*, XXXIV., 1902, 89–104). One here finds good illustration of the value and aid of physiographic explanation as a means of geographic description; the reason for this being that the relief of the state is on the whole moderate, and the elements of form hardly pass beyond the range of plain, hill, escarpment and valley, so that empirical description is baffling and confusing. The divisions proposed are all based on structure as modified by erosion and deposition. Cherokee lowland, a subsequent lowland twenty-five miles wide, crossing the southeastern corner of the state from Missouri to Oklahoma, is generally worn down to low relief on a belt of weak coal measures, but preserves occasional sandstone mounds on the divides; its streams flow in wide, flat-bottomed valleys bordered by low gentle slopes, the whole area

being 'practically down to grade.' The Osage prairies, lying next west, present a series of ragged, east-facing rock-terraces and outliers; the sinuous retreating escarpment of resistant limestones and sandstones, between which the weaker strata are worn to fainter relief. To the north, this area is blanketed with old drift, now dissected sufficiently to reveal patches of the underlying rocks. South of the center of the state is the Great Bend lowland, an extensive plain, more or less mantled with sands, close to the level of the Arkansas river, which flows through it; the plain has been eroded on weak shales, and is bordered by uplands of harder rocks. After several other areas, the High plains of the western third of the state close the essay; this division of the Great plains is described as still largely of constructional origin, its valleys being relatively small furrows when compared with the great extent of level upland remaining between them.

It is in this western and semi-arid part of Kansas that the summer traveler from rainier lands is surprised to recognize the rivers in the distance by the clouds of sand blown up from their dry channels: a peculiarity which has suggested the remark that 'one seldom sees rivers whose beds are so well aired as those of the Great plains.'

THE ALPS IN THE ICE AGE.

'Die Alpen im Eiszeitalter,' by Penck and Brückner, of which four parts have now appeared (Leipzig, Tauchnitz, 1901–2, 432 pp., many illustrations), promises to be a thorough and trustworthy monograph. The most notable characteristic of the work, as far as it is now published, is the admirably broad basis of fact upon which its generalized inductions are based. Many of these are of physiographic import. It is shown, for example, in the section on the northeastern Alps that the larger valleys repeatedly present a systematic succession of features for which glacial erosion and deposition are taken as the cause. These features are impressed upon a region which in preglacial time is believed on good reasons to have been a mountain mass of rounded forms, whose valleys opened northward upon a piedmont peneplain. Most important among the glacial features are the cirques of the valley heads, by whose excavation the subdued preglacial mountain masses were given sharp peaks and arêtes (as shown by Richter); the over-deepened main-valley troughs, with over-steepened lower side-walls and with discordant or hanging side-valleys; moraine-walled basins near where the over-deepened valleys broaden and open on the piedmont plain; groups of drumlins inside of the moraines, and extensive sheets of gravel, now more or less terraced, outside of the moraines. The repeated examples of these features, described, illustrated and mapped as occurring in orderly fashion in one valley system after another, are most instructive and convincing. Those who desire to review the work of ancient glaciers in the Alps can not do better than provide themselves with this excellent monograph as a guide for a fortnight's excursion in one of the valleys of the Tyrol.

It should be noted that these authors, and others of the same mind, have been led to conclude that large glaciers of strong slope deeply erode their valleys, not because of the discovery of any new facts regarding the erosive action of existing glaciers, but because of the unanimous testimony to this conclusion by the witnesses of glacial action in the past. Regions of extinct glaciers are unanimous in testifying to the repeated occurrence and systematic distribution of the features above named in their larger valley systems, while non-glaciated regions are equally unanimous in testifying to their absence. At the same time, well-grounded generalizations as to the normal development of valley systems by rain and rivers exclude Alpine cirques, over-deepened main valleys and hanging lateral valleys, basins, drumlins and moraines from among the possible features of such systems; while generalizations as to the modification of normal valley systems by temporary glacial action, on the assumption of active glacial erosion, logically demand the occurrence of precisely such features. Little wonder then that the theory of strong glacial erosion has found increasing

acceptance in recent years, since the unanimity of these many witnesses and the cogency of these generalizations have been recognized.

GLACIERS AS CONSERVATIVE AGENTS.

LEST the opinion in favor of strong glacial erosion should go too far, it is well to give special attention to such articles as explain by other processes the particular relation of over-deepened main valleys and hanging side valleys, to which so much prominence has recently been given in this connection. Bouney, writing on 'Alpine Valleys in Relation to Glaciers' (*Quart. Journ. Geol. Soc.*, LVIII., 1902, 600–702), recognizes the prevalently discordant relation of trunk and branch valley in certain parts of the Alps, but concludes, on the basis of 'personal examination of every part of the Alps, of the Pyrenees, the Apennines, Scandinavia, Auvergne, and many other hill and mountain regions,' that cirques are mainly the work of water; and that in a system of valleys, denudation would, on the whole, be checked where glaciers occupied the higher tributaries, and intensified by the action of torrents in the principal valleys. Garwood, discussing the 'Origin of Some Hanging Valleys in the Alps and Himalayas' (*Ibid.*, 703–715), also concludes that glaciers protect their floors. He explains certain striking examples of discordance between trunk and branch valleys in the Alps as the result of the accelerated erosion of the trunk valley on account of the steepening of its stream by a tilting of the region, while the side valleys, at right angles to the direction of tilting are not cut down, because their streams are not tilted. Kilian presents some 'Notes pour servir à la géomorphologie des Alpes dauphinoises' (*La Géogràphie,* VI., 1902, 17–26), and insists that the hanging lateral valleys of that district have been protected by glaciers while the main valleys have been deepened by normal stream work. Lugéon adduces the occurrence of rock sills that rise across certain Alpine valley floors, notably a sill known as the Kirchet in the Aar valley above Meiringen, and a similar sill in the Rhone valley below Martigny, to prove that the ancient glaciers were not destructive agents; had they been, these sills ought to have been removed; their presence is a 'peremptory argument against the deepening of valleys by glaciers' ('Sur la fréquence dans les Alpes de gorges épigénétiques et sur l'existence de barres calcaires de quelques vallées suisses,' *Bull. labor. de géol.*, Univ. de Lausanne, No. 2, 1901, 34 pp., excellent plates). This author takes no account of the hanging lateral valleys which are so abundantly associated with the main valleys of the Aar and the Rhone, and therefore naturally enough gives much importance to the rock sills, which in the theory of strong glacial erosion are explained as residual hard-rock inequalities in a much-deepened valley floor.

The manifest difficulty in the way of explaining hanging lateral valleys by the conservative action of the glaciers that once occupied them is the necessity of assuming a systematic, and persistent termination of many independent glaciers at the mouths of lateral valleys, for a period long enough to allow the main stream to deepen its valley by hundreds and to widen it by thousands of feet. The difficulty in the way of accounting for over-deepened main valleys by tilting, as suggested by Garwood, is that in the plentiful examples of tilted and therefore dissected districts in non-glaciated regions, the side streams cut down the side valleys about as fast as the main stream cuts down the main valley, and by the time the main valley is well opened the side valleys enter it at grade, in most accordant fashion. W. M. DAVIS.

THE MISSOURI BOTANICAL GARDEN.

FROM advance sheets of the administrative report on the Missouri Botanical Garden, presented at the recent annual meeting of the Trustees, it appears that the gross revenue for the year was $124,431.89 and the total expenditure $119,893.84, of which $25,352.64 was spent for the maintenance of the garden proper and $8,186.46 for improvements and extensions in this department; $3,015.81 for the herbarium; $6,595.40 for the library; $5,086.67 for administrative expenses at the