however, that the excavation of valleys or gorges like these by rivers, when the slope and water supply are favorable, occurs with such rapidity relative to the wider effects of denudation, as to be almost negligible in any general view of the physical changes of an extensive region or in the accounting of geological time.

There is as yet some difficulty in connecting the later physical changes particularly referred to above with those which have recently come under observation far to the north in the Klondike region. It is probable, however, that the auriferous 'quartz drift' of that region, implying long subaërial decay and stability of level, may be attributed to the early Pliocene; while the river gravels found in the newer and deeper-cut valleys may be assigned to the later Pliocene time of greater elevation. During the Pliocene, and probably until its close, the mammoth, one or two species of bison, the moose and other large mammals roamed northward to the Arctic sea. Then came the Glacial period, with renewed great changes in levels and climate and its own peculiar records and history, which in many respects are more difficult of interpretation than those of more remote periods, because the whole time occupied by them has been relatively so brief. I have elsewhere endeavored to follow this history in detail, and do not propose on this occasion to deal with this latest chapter of the physical history of the Rocky Mountain region of Canada.

In conclusion, what appear to be the most striking points evidenced by the geological record of this northern part of the Cordillera may perhaps be specified as follows:

1. The great thickness of strata accumulated both to the east and west of an Archean axis. In the Laramide geosyncline the strata no doubt actually attained the volume stated. In the western and wider syncline it is not so certain that all the formations in their full thickness were ever actually superposed at any one place or time (for reasons already alluded to), but the volume was probably not less than in the Laramide region.

2. The great proportion of volcanic materials accumulated in the western geosyncline and the recurrence of vulcanism throughout the geological time-scale in this region, resulting in the production of massive volcanic formations in the Cambrian, Carboniferous, Triassic, Cretaceous and Miocene.

3. The recurrence of folding and disturbance parallel to the border of the Pacific basin and the concurrent great changes in elevation of the land relatively to the sea, both continued down to quite recent geological times, the latter even into the Pleistocene.

4. The tremendous energy of denudation, in part due to the events last referred to, but also dependent upon the position of the region on the eastern border of a great ocean, where, in northern latitudes, an excessive rainfall must have occurred at all periods on the seaward mountain ranges. No comparable denuding forces were probably ever operative on the east side of the continent in similar latitudes since the definition of the ocean basins of the Pacific and Atlantic.

G. M. DAWSON.
GEOLOGICAL SURVEY OF CANADA.

STEREOSCOPIC STUDY OF THE MOON.

IN looking at a terrestrial landscape we see that certain features are distant and others near. We also recognize the extension of objects in three dimensions, so that a tree, for example, is not a mere silhouette, but is perceived in its proper rotundity. The data for these automatic and instantaneous judgments as to distance and form are somewhat complex. The distance of objects of familiar character is judged in part by their apparent size—the principle of lunar perspective. Distant objects, being seen through more air, have a different color from near objects—the principle of aërial perspective. For objects in the foreground we have two retinal pictures which are sensibly different, and from these the eyes estimate distance—the principle of optical parallax. The judgments arising from optical parallax are automatically combined into judgments of the rotundity or solidity of objects. If the sun shines, many objects show one side illuminated and the other side in shadow, and a shadow is also cast on the ground or on adjacent objects. From long association with judgments arising from optical parallax we have come to infer rotundity from the distribution of illumination and non-illumination—the principle of shadows. Finally, sunlight is scattered and reflected from particles in the air and from objects in the landscape so as to come with modified intensity from many directions, affording partial illumination to surfaces not directly exposed to the solar rays. This partial illumination we have learned to interpret in terms of rotundity—the principle of shades.

When one looks at the surface of the moon through a telescope of high power he sees a landscape from an unfamiliar direction and under unfamiliar conditions. As all the objects are strange, he is not aided by linear perspective. As there is no foreground, he is without the assistance of optical parallax. As the moon has no atmosphere his view is devoid of aërial perspective and of shades. It is true that the moon receives reflected light from the earth and there must also be reflection from lunar cliffs, but these reflected lights are so faint as not to help the seeing of surface details; so far as the eye can determine, the lunar shadow is absolutely black. The observer, being deprived of all other data, has to depend wholly on light and shadow, complete illumination and the entire lack of illumination, for his determination of the configuration of the surface. The sense of sight, having been educated by terrestrial landscapes, is unprepared for the peculiar conditions of the lunar landscape and gives false judgments. Close to the terminator, or sunrise line, where light and shadow divide the field, the eye overestimates the relief and sees the topography as grossly exaggerated as some of the published sketches of lunar mountains. At a distance of 40° or more from the terminator the landscape is practically without shadows, but is diversified by spots of color representing the distribution of the various substances composing the moon's face. These colors, being chiefly light and dark grays, are interpreted by the eye as shades and give an impression of relief no less false than that obtained at the terminator. Along an intermediate zone the general effect as to altitude is substantially true, but it can hardly be doubted that many details of form are misconceived.

Professor W. Prinz, of Brussels, has hit upon an ingenious method of avoiding these difficulties and realizing the actual relief. For many years the rotundity of the moon as a whole has been exhibited by means of the stereoscope. The possibility of this depends on libration, which permits us to view the moon from different directions ranging through an arc of about 16°. Two photographs taken in different months and at times properly chosen, and afterward viewed through a properly constructed stereoscope, give the same fulness of relief which we obtain in observing an object at a distance of 9 inches. Professor Prinz has applied the same method to the examination of small portions of the lunar surface greatly magnified, and is thus enabled to see the craters and other details in their natural proportions. To get the best effect he uses positives printed on glass and moderately illuminated before a specially arranged background. The details are set forth in a small pamphlet* which may be advantageously studied by any one who cares to employ the new method.

It will be observed that the stereoscopic method gives the shapes of lunar features in terms altogether independent of those afforded by telescopic observation. The data furnished by the telescope serve through the principle of shadows; the data of the spectroscope serve through the principle of optical parallax. In the stereoscopic view light and shadow join with local color in defining points and spots, and all points are thrown into proper relation through their parallaxes.

G. K. GILBERT.

A FURTHER STUDY OF THE UNIT SYSTEM OF LABORATORY CONSTRUCTION.

IT is desired to present a series of drawings with the necessary explanations to illustrate the practicability of designing a laboratory on a unit system. These drawings are the outcome of a somewhat careful study of the problem and of discussions with a number of experienced laboratory administrators. They seem to me to demonstrate the entire possibility of constructing a laboratory upon the unit system.

In a previous article, which was published in the *Philadelphia Medical Journal*,† it was maintained that the unit system of Laboratory construction offers real and very great advantages. The advantages are architectural, administrative and for the work of instruction.

The architectural advantages are those of facility and flexibility of design, and those of convenience and economy of construction. It is evident that if the essential requirement is to provide a number of rooms of uniform and moderate size, abundantly lighted and conveniently accessible, then an architect has a comparatively simple problem, which may be carried out in a great variety of designs, and may be readily adapted to special situations and conditions. Such a requirement leaves an architect great freedom as to the exterior of the building, which generally seems as important to the architect as the interior arrangements are important to the owners and users of a building. One indispensable exception to the exclusive adoption of the unit rooms will recur, in probably every case —namely, that of lecture rooms. As regards the construction, I am informed that it would cost less for a building on the unit plan than for one of equal capacity but with rooms of the customary irregularity of size.

The advantages of administration are manifold. Most valuable will prove, I think, the possibility of changing the uses to which the rooms may be put, for not only may the use of a given room for one object or another of a given department be changed, but it may be transferred wholly to a different department, for a unit room as proposed will be equally adapted to the needs of, for example, chemistry, botany, anatomy or physiology—its adaptation to the special needs of any of these sciences depending only upon the furniture put into it. Within a single department a unit room may be applied to many different uses. It will be of convenient dimensions for a class of elementary study, a smaller class of advanced students, or a still smaller number of research men, or of assistants. It can be subdivided into two smaller rooms by temporary partitions. It will be convenient for collections, for a library or reading room, or for a small lecture room. The particular use of any room can be changed

*De l'emploi des photographies stéréoscopiques en sélenénologie. Extrait de l'annuaire de l'Observatoire royal de Belgique pour 1901. 27 pages.

† Vol. VI., p. 390, Sept. 1, 1900.