clusively demonstrated by comparing Tables I. and II. The first of these tables shows, with only two exceptions, namely, at noon and 4 P.M. December 22, that at the time when the observations were made there was an ingoing current. Table II., which gives the barometrical readings, shows that the time of recorded ingoing currents, except at noon, December 24, was during the time of increasing atmospheric pressure; and that in the two exceptional cases, which showed outgoing or no currents, the atmospheric pressure was decreasing. In other words, the outgoing currents always take place during rising barometer, and ingoing currents during falling barometer. As the atmospheric pressure usually increases daily from 4 A.M. to 10 A.M. and decreases from 10 A.M. to 4 P.M., it follows that springs, wells and caves of this class will generally have an indraft in the forenoon and an outdraft in the afternoon. If the daily variations of atmospheric pressure were regular, the ingoing and outgoing currents would also be regular and would take place at the same time each day. However, as the daily maximum and minimum barometric readings may vary greatly from day to day, due to approaching storms or other causes, the ingoing and outgoing currents will not always act with the same energy.

In the second class of wells and springs, the constantly outgoing or the constantly ingoing current is entirely independent of atmospheric conditions. The currents, whether outward or inward, act with equal energy during high or low barometer and always move in the same direction. The Boston and the Lester deep wells are excellent examples of wells and springs of this class. The phenomenon which they exhibit seems to be due entirely to the friction of the air on a rapidly moving current of water. This phenomenon is beautifully illustrated in Richard's water air-blast, to be found in many well-equipped chemical laboratories. In the Boston well, and also in the Lester well, appear almost exactly the same conditions met with in Richard's water air blast. The well itself forms the inlet for the air, and the rapidly flowing stream in the subterranean channel below completes the conditions necessary for an ingoing air blast. As the air in the wells here named is constantly drawn in, it naturally follows that it must escape at some other point as an outgoing current, thus giving rise to continuously blowing caves or springs.

As underground streams frequently pass from one bed of rock to another in their subterranean course, they, no doubt, often form waterfalls which possess all the essential conditions necessary for producing an air blast, thus giving rise to continuously blowing caves and springs.

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CURRENT NOTES ON LAND FORMS

GLACIATION OF THE BIG HORN MOUNTAINS, WYOMING

A RECENT report on the 'Geology of the Big Horn mountains' by N. H. Darton (Prof. Paper 51, U. S. Geol. Surv., 1906; excellent plates) describes the range as a wide anticline with steeper dips on the east, eroded sufficiently to expose its granitic core over the broad arching crest, while scalloped ridges of the more resistant members lie along the flanks and in places stretch over toward the axis of the range. R. D. Salisbury presents a chapter on glaciation—in which there is to our view an insufficient recognition of the previous work of F. E. Matthes on the same district—showing that many glaciers occupied the upper valleys during the last glacial epoch. Erosion by these glaciers, working in valleys that had been previously developed by normal preglacial erosion, is held responsible for 'the development of cirques, the cleaning out of the upper parts of the valleys through which the ice passed, the rounding and widening of the valley bottoms, the polishing of the rock surfaces in the valleys and the excavation of some of the lake basins.' The cirques head in superb cliffs, which rise abruptly to the broad highland surface of the unglaciated granite; sharply serrate ridges occur where the widening of neighboring cirques and troughs has consumed the intervening highland surface; here the mountains gain a distinctly Alpine form. As to the strength of glacial erosion in excavating the valley troughs, it is said that 'not a few of the valleys may have been deepened 400 to 700 feet in their upper parts, while in some cases * * * the deepening may have been considerably more.' In view of this, explicit mention of 'valley deepening' as well of the 'rounding and widening of valley bottoms' might have been made in the list of features for which glacial erosion is held responsible, as quoted above. Here, as in so many other glaciated valleys, the depth of the glacial tarns, many of which occur in the upper reaches of the valleys, is by no means a full measure of the depth of glacial erosion—the rock basins simply indicate an excess of erosion at one point over that next down-valley, a fact which might have been more clearly presented. Hanging lateral valleys occur but are not numerous; nevertheless they certainly deserve a place in the list of 'the distinctive features of glaciated mountains,' where for some reason they are omitted.

The morainal deposits, which occur where the local glaciers ended in the descending valleys on the mountain flanks, are discussed in some detail; good examples of moraines and morainal lakes are figured. About half of the lakes of the district—all of small size—are of this origin; the other half occupy glacially excavated rock basins higher up the valleys, as already indicated. Changes in drainage due to glacial erosion are noted, an example of glacial capture previously reported by Matthes being here figured. (The titles of two figures illustrating this 'capture' have been by oversight interchanged.) A case is cited in which a glacier failed to remove all the decayed rock at a certain point, while rock surfaces not far away show severe wear. Although this is a minor feature, and certainly to be expected as a common result of glacial activity, the citation is of importance in connection with other cases of larger area where the failure of a glacier to remove decayed rock has been urged as evidence of inefficiency of glacial erosion in general. The facts, as here recorded, again emphasize the principle that glaciers, like rivers, erode vigorously in one place, feebly in another, and make extensive deposits in a third.

D. W. J.

GLACIAL EROSION IN THE HIMALAYAS

It has been frequently remarked by those who are still unconvinced of the capacity of glaciers to deepen valleys and excavate lake basins, that the absence of valley lakes in the glaciated districts of the Himalayas is strong testimony on the negative side of the problem. The reply has been made that the glaciated parts of the Himalayan valleys probably had so strong a slope in preglacial time that the overdeepening by glacial erosion did not produce profound lakes, and that such lakes as were produced have already been filled with waste by the heavily loaded rivers of those lofty and often barren mountains. But a specific example of glacial erosion in the inner Himalayan region east of the vale of Kashmir, has recently been described by Ellsworth Huntington, under the title, 'Pangong, a glacial lake in the Tibetan plateau' (*Journ. Geol.*, XIV., 1906, 599–617), from which it appears that valley glaciers have actually produced lakes there, as well as in other mountain ranges. Pangong, or Pangkong, at an altitude of 14,000 feet, about 40 miles long and 142 feet deep (as stated by Drew), is the distal member of a series of lakes of which the total length is 105 miles, with a maximum breadth of four miles. The enclosing mountains rise in steep slopes for the first 1,000 or 2,000 feet, and then at gentler slopes 3,000 or 4,000 feet more to peaks 20,000 feet in altitude. Large moraines, old enough to be much eroded, are found some twenty miles down the main valley from the end of the lake. Glaciated knobs are found along the valley floor, perched erratics occur up to 600 feet over the lake surface, and at least one lateral valley hangs distinctly above the main valley. Pangong does not overflow at present; its surface is thirty-five feet lower than a barrier, a mile farther down the valley, which Drew took to be an alluvial fan formed by a side stream, but which Huntington gives good reason for regarding as a rock sill or inequality in the deepened valley floor. The glacial origin of this string of lakes thus seems to be reasonably well attested. Postglacial climatic changes, indicated by abandoned shore lines, are discussed in some detail.

W. M. D.

POSTGLACIAL AGGRADATION OF HIMALAYAN VALLEYS

THE possibility that glacially overdeepened Himalayan valleys have lost their lakes in consequence of postglacial aggradation, as suggested at the beginning of the preceding note, is supported by the features of the Shigar valley, northeast of the vale of Kashmir, as described in an admirable essay on 'Die Thäler des nordwestlichen Himalaya,' by K. Oestreich, topographer of the Workman expedition, 1902, and now Docent in Marburg University (*Peterm. Mitt. Ergänz'hft,* 155, 1906: 36 exceptionally fine plates). This valley was invaded by huge glaciers from the lofty Mustag range on the north, where glaciers of great size still remain; and Oestreich points out the strong contrast between the broad glaciated trough of the Shigar and the narrow gorge of the Indus which the Shigar joins, the village of Skardu lying near the junction. The Indus in its northwestern intermontane course follows for 150 miles (except near Skardu, as stated below) a young gorge, eroded some 200 meters beneath the floor of an earlier, larger and more mature valley: the sides of the gorge show numerous ledges between incompletely graded slopes; the bottom has no continuous flood plain, but only local sandbanks at the base of the convex spurs; the road can not follow the river, but has to rise and fall on the spurs of the valley side. The Shigar valley, on the contrary, is described as having been widened and deepened by glacial action: it has a broad, aggraded floor, on which the river divides and wanders in a braided course: the valley sides are glaciated and carry patches of glacial deposits. The barren slopes of the desert mountains are believed to have aided in supplying waste with which to aggrade the overdeepened valley. Similar features are found also in a middle portion of the Indus valley—the Skardu basin—for some twelve miles below the entrance of the Shigar; and again, to a less degree, for some twenty miles farther up the Indus to the entrance of the Shayok, which like the Shigar brought in a great glacier from the north. Before the Skardu basin was filled with gravel, there is much probability that it contained a lake.

It is singular to note that, although Oestreich ascribes the deepening and widening of the Shigar valley to glacial erosion, he explains its continuation in the Skardu basin as the result of tectonic movements: the glaciers did not, he says, deepen the basin by erosion, but the deepening of the basin by deformation attracted the glaciers to it. The text is unfortunately not detailed enough to enable the reader to reach an independent judgment.

W. M. D.

UPLIFTED PENEPLAINS IN THE HIMALAYAS

IN a later section of the essay referred to in the foregoing note, Oestreich gives an excellent description of the highlands of Déusī—the Deosai plains of English travelers—and accounts for them as an uplifted and not yet dissected peneplain. They have a somewhat circular area, 24 kil. in diameter, and stand at an altitude of from 3,800 to 4,000 met.; their gently undulating surface, sometimes surmounted by subdued hills, shows no sympathy with the deformed structure of their mass. Mountains rise around them to 5,000 met. except on the southeast, where their streams escape. The whole surface has been glaciated, and is now clothed in summer with grass and flowers. It is pointed out that the Déusī highland is the only example of its kind on the near side of the river Indus, but that similar highlands exist farther inland, especially in Tibet.

It thus would seem that, as far as this part of the Himalaya is concerned, it falls in with a number of other mountain ranges—as recently pointed out for the Alps by Penck, for the Carpathians by Martonne, for parts of China by Willis, to say nothing of various ranges in the United States—in owing its altitude not to the deformation by which its disordered structure was caused, but to a broad uplift which took place long enough after the period of deformation for erosion to have greatly lessened or almost destroyed whatever unevenness of form the deformation produced.

W. M. D.

A MATHEMATICAL EXHIBIT OF INTEREST TO TEACHERS

For the benefit of students and teachers of mathematics who may be visiting Columbia University, the department of mathematics in Teachers College has arranged a permanent exhibit of material available for the study of the history and teaching of the subject. One feature of the exhibit is a collection of mathematical apparatus and models adapted to the needs of the various grades from the kindergarten through the high school, including games, mensuration blocks and models usable in geometry and trigonometry.

In addition to Professor Smith's library of several thousand books and pamphlets upon this subject, there is also available his collection of mathematical instruments—some dating as far back as 1450—of manuscripts, and of engravings and portrait medals of eminent mathematicians.

The early mathematical instruments exhibited include the following: an astrolabe of Arabic workmanship; one of Italian workmanship, signed by the maker, and dated 1509; another, a part dating from about 1450, and the rest, including the four plates, from the following century; and one of Paduan workmanship, signed by the maker, and dated 1557, a practically perfect specimen, with five finely engraved plates. There is also a quadrant of the sixteenth century, one of the primitive instruments of trigonometry, bearing the early names 'Umbra recta,' and 'Umbra versa,' together with several leveling instruments of the seventeenth and eighteenth centuries. There are also numerous measures of length and weight, of the seventeenth and eighteenth centuries, including the ell and some interesting sets of money changers' weights; several finely engraved protractors, diagonal scales, and similar instruments; several sector compasses and compasses of other kinds, of the Renaissance period; a collection of typical forms of dials to illustrate the application of mathematics to dialling in the Renaissance period, and several armillary spheres of the sixteenth, seventeenth and eighteenth centuries.

The material used to illustrate the development of mechanical calculation includes the following: a collection of medieval counters (jetons, reckoning pennies) of fifteenth and sixteenth century workmanship, partly French and partly German, some with the figure of the Rechenmeister seated at the abacus. Books showing the process of calculation by means of counters 'on the line' are also exhibited. There are also to be seen an Arabic abacus, a Russian tschotü, a Chinese swanpan, a Japanese saroban, a set of Napier's rods, and a set of Korean bones (the modern form of the ancient Chinese 'bamboo rods,' or the Japanese Sangi). Some Japanese books of 1698 are exhibited showing the transition from this latter form of computing to the saroban, which took place in Japan about that time. Besides these there are shown several modern calculating machines, including the Goldman and Stanley arithmometers, slide rules, and similar devices. There are also available for study, in addition to those displayed, several early treatises showing the use of counters, together with numerous works on the historical development of this phase of arithmetic. This is also extensively illustrated in a collection of stereopticon slides belonging to the department.

There are in Professor Smith's library about two thousand portraits of mathematicians. Of these it is possible to exhibit only a relatively small number. About forty are framed and can readily be examined, and visitors wishing to examine others in the collection are assisted in doing so. This part of the collection represents the work of a number of years and the repeated examination of the stocks of many European dealers. It is particularly rich in the works of early engravers, although containing a considerable number of photographs and modern process portraits. Reproductions of a number of the portraits have been made for school and college use by The Open Court Publishing Co., of Chicago.

The collection of Newtons includes all