tion of geographic forms has been attempted, and there is no "thorough and consistent physiographic terminology;" but systematic incursions have been made into this field by meteorologists, by engineers, and notably by American geologists. The geologist is not, for example, chemist also, because chemistry aids in geologic investigation, but here, from necessity, the geologist is also physiographer. The effect of this orderly work upon the study of physiography, though in the nature of clearing away outlying obstructions to adjoining interests, is seen in the scientific beginnings of a terminology that may be assembled from the writings of Gilbert, Davis, Chamberlin, and others.

The term 'topography,' it would seem, has, within a few years, been appropriated as a general designation for those superficial forms which have recently received attention as both the product and the promise of so much in geologic evolution. The surveyor made little progress in hill-drawing until it was seen that many obscure geologic facts bore, in surface form, a typical expression that could be readily interpreted. As the director of the Geological Survey said recently, in his testimony before the 'Joint Commission' for the investigation of the scientific bureaus of the government, "the most fundamental connection of geology is with topography, because geology has for its purpose, either directly or remotely, the explanation of topography. . . . All the vigor and energy which are devoted to topography in modern times arise from its geologic relations." To meteorology, and to the broader problems of engineering, surface shape, or surface shaping, also bore complex relations; to engineering it set examples; to meteorology it was a known quantity in an intricate problem; to geology it was the beginning and the end. There were recognized "a topography of the land and a topography of the sea," and, in each, characteristic type-forms, both of erosion and of deposition. The type-forms of erosion were seen to vary with the nature and grouping of materials, so that each class of rocks had its own distinctive topographic expression. The recognition of a 'topography' of coal, and of the allied natural products, in the mining regions of Pennsylvania, is of acknowledged economic importance; and glacial history is traced more successfully through its splendid topographic record than through the composition characteristics of its drift.

Obviously a distinctive term is needed here, in the more discriminative modern geology and allied sciences: from recent inquiry into usage, on this point, I cannot but think that 'topography' has been adopted in this definitely restricted sense, and will hold. For example, in a standard treatise on roads, by Lieutenant-Colonel Gillman of the Engineer Corps, this occurs: "In laying out important roads, and especially in locating streets, in thickly settled districts, it is well to place contour curves upon the map. These curves indicate at once, to the practised eye, the topography of the country which they embrace." Dr. Woeikof, meteorologist and professor of physical geography in the University of St. Petersburg, devotes a chapter in his recent book, 'Die Klimate der Erde,' to the 'Variation of Temperature with Altitude, with Particular Regard to the Effect of Topographic Form on Temperature Changes,' as interpreted in *Science* of the same number with Mr. Davis's letter, cited above. In the newer geological reports abundant instance may be found of this use, for example, here and there: "Change in the character of the rocks produces corresponding change in the topography; the soft mica-schists have been worn by erosion into broad parks and valleys, intervening with rounded peaks and ridges of harder strata;" "the main topographical features of this country are the results of erosion, aided and modified by faults and folds, to which volcanic rocks have added many interesting features, mainly by the resistance which they offer to denudation;" "the contrast of hard and soft has determined the main features of the topography. . . . These have been made to give expression to the main facts of the geologic structure;" "the former [a beach line] crosses the irregularities of the pre-existent topography as a contour, the latter [a fault] as a traverse line . . . a system of shore topography, from which the ancient lake has receded, is immediately exposed to the obliterating influence of land erosion;" "the topography was not too rough on the one hand, nor so low and flat as to be submerged, on the other . . . as the peculiar character of the topography of the moraine varies through a somewhat wide range, and sometimes simulates very closely the surface aspect assumed by other formations, the study of topographical types becomes one of essential importance . . . a topographical species absolutely impossible of formation by drainage agencies." Upon the first appearance of the proof-sheets of the new topographical survey of Massachusetts, a year or more ago, the work was commented on editorially in *Science*, in part as follows: "The curious Hopper of Mount Greylock, with its deep-cut valley, is one of the best marked topographic forms in the State . . . what is now needed is the local examination of minute topographic details so that we may learn to see and appreciate the forms about us at home; and nothing will lead sooner or surer to this long delayed end, than the publication of good topographic maps."

I do not think that the term has acquired this association through exceptional fitness of its own, though small objection can be urged on etymological grounds, but because it was in the field, and out of serious employment. Originally it meant place-description, or, as applied to surveying and maps, simply detail, or the art of portraying it. Early topography was, however, singularly unobservant of surface configuration. When the important bearing of surface expression on geologic problems came to be recognized, related topographic work became more appreciative of this additional feature in place-description. Maps of the novel sort were at once recognized as the only completely topographic maps, and to their distinctive characteristic, finally, the term 'topography' got exclusively to apply.

From this point of view, then, in a map, the expression given to the vertical element, whatever the symbol employed, is 'topography;' the drainage, — stream, pond, or marsh, — the obvious agent, destructive or constructive; and the 'culture,' an incident. The term is still in use in the old sense, among surveyors and engineers; and it may, perhaps, continue so, without confusion, as, in turn, a technical meaning. WILLARD D. JOHNSON.

Templeton, Mass., Sept. 13.

A Living Glacier on Hague's Peak, Colorado.

FOUR years ago, Mr. W. L. Hallett of Colorado Springs, while crossing an ice-field on Hague's Peak, stepped into a crevasse which had been hidden by a thin layer of recent snow, and narrowly escaped a serious accident. The crevasse suggested to him that this snow-field was really a glacier. Since that time the place has been visited by only five or six persons. Among these were Mr. Chapin of Hartford, Conn., a member of the Appalachian Mountain Club, who is said, during last July, to have pronounced the formation to be a true glacier. I have recently examined the region, and the following is a brief statement of the principal facts observed: —

From Long's Peak northward to Hague's Peak is a line of noble mountains thirteen thousand or more feet high. The numerous tributaries of the Big Thompson River take their rise in snow or rather ice fields which are situated in basins or mountain cirques far above timber-line near the summit of the range. The upper parts of the valleys of these streams were all glaciated in ancient times, and are bordered by moraines which in some cases extend down into Estes Park. This region is marked on the maps of Clarence King as having formerly been glaciated, but no moraines are shown on Hayden's large map of Colorado. Several of the ancient glaciers are shown by the moraines to have been more than ten miles long, and some of them were at least fifteen miles. Near the post-office marked Moraine on Hayden's map, the moraines are well developed as ridges having steep slopes on each side. They are from a few feet up to about two hundred feet high, and in places are perched on the mountain-sides five hundred feet or more above the bottom of the valley. Going up these valleys, one sees a succession of terminal moraines, showing that there has been a gradual recession of the ice.

The ice-field on Hague's Peak is in a basin roughly semicircular in shape, situated on the east face of the northern spur of the mountain. The basin is small, — hardly one-fourth of a mile in diameter, — and is at the head of a deep valley which drains east, and then south-east, into the Big Thompson. This valley was once occupied by a large glacier, as shown by moraines, by a number of glacial lakelets in the bottom of the valley, and by moutonned bosses of rock. Just below the ice-field a broad moraine ex-

tends across the whole valley. Having climbed to the top of this huge pile of rather angular blocks, you suddenly discover a small lake between the moraine and the ice. The moraine, in part at least, is the barrier that holds back the water of the lake. Except at the outlet of the lake, this moraine rises above the present level of the ice, — in some places fifty feet or more, — and therefore must have been formed at a time when the ice stood at a much higher level than now. The lake is rather less than one hundred yards in diameter. It is locally known as the Frozen Lake, being covered by a weak, granular sort of ice even in midsummer. Floating on the surface of the lake were several blocks of quite solid ice from six to twenty feet long, and rising from two to twelve inches above the water. These little icebergs have evidently broken off from the thin edge of the glacier, which ends in a small cliff from one to three feet high.

The material of the ice-field, though somewhat granular on the surface, is not a mass of snow, but a clear and compact ice. This was determined by observation at the crevasses, and by cutting into it. The surface is deeply furrowed by rains and the water of the melting ice running down the slopes.

The principal crevasse is curved so as to be nearly parallel with the shore of the lakelet, and is not far from one hundred feet back from it. On the upper side of the crevasse the plane of fracture is nearly at right angles to the surface of the ice, but on the lower side the ice has been tilted over; so that, while the crevasse is about ten feet wide at the surface, it is very narrow at the bottom of the ice. The lower parts of the crevasses were filled with snow and broken icicles, ice stalagmites, etc., so that only from twenty to thirty feet can be seen. How much deeper the crevasses really are, is not known; but, from the size and shape of the ice-field, it does not seem probable that the greatest depth of ice exceeds fifty or seventy-five feet. Above the main crevasse were two others large enough to be seen through the recent snow. The number of crevasses is greatest north of the centre of the glacier, where there is a more direct exposure to the sun.

Standing at the lake, you see the glacier sloping steeply down toward you from the south, the west, and the north, somewhat like the seats in a theatre. This causes the ice at the north end of the glacier to flow south, while at the south end it is flowing in nearly the opposite direction. As a result of this peculiar shape, the glacier is somewhat wider than it is long; but it is not exactly symmetrical. On the north side of the valley the ice reaches about two hundred feet farther down the valley (eastward) than on the south side, and it has also extended a tongue of ice southward across the outlet of the lake, so that the outlet is by a subglacial channel. This tongue of ice is nearly one hundred feet wide, and rises six or eight feet above the lake. Some interesting questions suggest themselves as to the cause of the ice having receded farther on the shady side of the valley, the effects of different exposures to the sun, the relative protection afforded by different-sized moraines, inequality of snowfall on the opposite sides of the valley, etc. The depth of recent snow made it impossible to properly examine beneath the edges of the moraines to determine if there is beneath them any ancient and now quiescent ice. Omitting these more complicated questions, it seems probable that the extension of that tongue of ice across the outlet of the lake is, partly at least, caused by a more rapid rate of flow of the ice on the north side of the valley, where there is a more direct exposure of the sun. The slopes of the ice are everywhere steep. In places they would be considered steep for the roof of a house.

It was of special importance to determine if moraines are now being deposited. I saw no evident moraines and only two small pieces of rock on the ice anywhere. The cliffs around the head of the glacier are nowhere very high, in places rising only a few feet above the ice, and they are surprisingly bare of loose fragments. It is just as if the greater glacier of the past had removed all loose material, and the process of weathering has not yet had time to split up the rock and furnish fresh *débris*. Some of the bowlders in the lake come near the surface, and may be a recent terminal moraine. Perhaps a careful examination when the ice is bare of recent snow may reveal moraines now forming; but, if so, they must be small, since there is so little moraine-stuff being cast upon the ice.

There are several other 'snow-fields' in the vicinity of Long's Peak which show some signs of glacial flow. Stakes ought to be set on the surface of these ice masses (for they are all ice rather than snow), and their motions accurately observed.

The view from Hague's Peak is one of the finest in the Colorado Mountains. A trip to this mountain and its small but interesting glacier will rank well with the ascent of Pike's, Gray's, or Long's Peaks. The height of Hague's Peak, as given by Hayden, is 13,832 feet, only 439 feet lower than Long's Peak. The glacier is approximately in north latitude 40° 28′.

From the name of the discoverer, this is known as the Hallett Glacier.

G. H. STONE.

Colorado Springs, Sept. 13.

Condensed Milk.

A CURSORY examination of several cans of preserved milk, that were offered for sale in this State at a price below the actual cost of manufacture, revealed the fact that much of this milk was of poor quality, while some was unfit for use; hence, in the early part of this year, a thorough investigation was made of all the brands of canned milk on sale, and samples were sent to Prof. H. B. Cornwall, of the John C. Green School of Science, Princeton, for analysis. His report, here printed, is of sufficient importance to warrant its publication in advance of my annual report to the Legislature.

WM. K. NEWTON.

Office of the Dairy Commissioner of New Jersey,
Paterson, N.J., Sept. 17.

DURING the first five months of this year a number of samples of condensed milk were received from the State dairy commissioner, and analyzed by the writer, with the result stated in this paper. All but two were condensed with the addition of cane-sugar. While the milks condensed without sugar may be better for infants and invalids if not kept long in cans, yet they are not certain to remain sound, even in the sealed cans, for any length of time, and are therefore of doubtful value.

The milks preserved with cane-sugar, on the other hand, if carefully prepared, keep well in cans, and do not spoil very rapidly even after the cans are opened, provided the can is kept in a dry place and no water is mixed with it. For use with tea and coffee, and for making puddings, custards, etc., they are an excellent substitute for fresh milk.

The very large amount of cane-sugar necessary to preserve them renders them, however, an unwholesome food for infants, and they can by no means be regarded as a good substitute for fresh milk in this case.

The directions on the cans in general state, that, by adding a certain quantity of water, the condensed milk can be made to resemble cream; by adding more, it becomes the equivalent of milk. This can never be true: cream contains from three to four times as much fat as the average condensed milk, and no dilution with water will make such milk resemble cream except outwardly. It would be well if all makers would follow the course pursued by a few, and, while giving such directions as are necessary in using the milk for making desserts, etc., recommend that the advice of a physician be obtained as to the diet of infants. Condensed milk preserved with sugar can never be a fit food for infants.

In some instances very misleading statements as to the quantity of fresh milk condensed to produce the contents of the preserved milk cans were made. It will be seen that the condensation is very rarely more than threefold, and usually somewhat less.

A well-made condensed milk, with cane-sugar, should show very little if any undissolved sugar, and should be of a nearly white color, having but a faint yellowish tinge. It should have no cheesy taste or smell, and should dissolve readily in about four parts of cold water. Especially should it dissolve without showing separated flocculent particles of caseine or curds.

METHOD OF ANALYSIS.

To insure thorough mixing, the entire contents of the can were emptied into a porcelain vessel and thoroughly stirred; 40 grams of the milk were weighed out and diluted with water to 100 cubic centimetres, so that 5 cubic centimetres of the diluted milk corresponded to 2 grams of the condensed milk.