Can we not then conclude that the forcing of acceptable food and drink into the pharynx is not 'instinctive,' but is the result of a series of satisfactory discoveries of the young bird which lead up to the placing of the food where it will bring about the stimulation of the reflex center of the gullet and the accomplishment of the final act of swallowing—a series which is intelligently adopted by the bird and improved by practice.

It is perhaps well, before closing, to revert to the peculiar habit of the bird in snapping at falling drops. From the first, the attention was markedly attracted by flying insects and any small objects in motion seemed to have a peculiar charm. From this fact I am inclined to think that the seizing of drops was no more than the striking at moving objects, though it is possible that the adult habitually takes water on the wing by seizing falling drops of dew or rain. H. C. BUMPUS.

A NORTHERN MICHIGAN BASELEVEL.

KEWEENAW POINT and its southwestern extension in northern Michigan is composed of rocks of Keweenawan and Cambrian ages, and exhibits three chief topographic features. Beginning at the south is a broad area of the so-called Eastern or Potsdam sandstone. This is in a horizontal position, and rests unconformably upon the rocks to the north and south. North of this area is the main trap range of the Keweenawan, which consists largely of basic lava flows, but with lesser quantities of acidic lavas. Interstratified with the lavas are numerous layers of sandstone and conglomerate. The majority of these are thin, but in the upper parts of the series some of the conglomerates are of considerable thickness. The breadth of the main trap range varies from about 4 miles to nearly 10 miles. In a general way the traps and detritals strike northeast and southwest, and dip to the northwest at angles varying from 25° to 55°. At the southwestern part of the area considered, a wing of the trap range swings to the north as the result of a fold. This area is known as the Porcupine mountains. The distance from the southwest part of the Porcupine mountains to the end of Keweenaw Point is about 120 miles. To the northwest, overlying conformably the main trap range, is the upper division of the Keweenaw series, which consists wholly of conglomerates and sandstones. The dips on its southeastern border average about 25°, but they become less and less toward Lake Superior and at the shore they do not average more than 8° or 10°.

For a full description of the Keweenaw series see the Copper-bearing Rocks of Lake Superior, by Roland D. Irving, Monograph V., United States Geological Survey, and in connection with the present description see the maps of plates I., XVII., and XIX.

A recent visit to this area convinced me that this district had been almost completely baseleveled. The two most advantageous points found by me from which this baseleveled area may be seen are, first, the top of the hill occupied by a church in the village of Rockland, and, second, the top of the rockhouse of the Quincy mine, occupying the highest ground above Hancock. From the Rockland point, looking to the northeast the main trap range appears to be an almost level plain. To the southwest the plain is nearly as level, but the Porcupine mountains rise considerably above this plain. The explanation of this monadnock is simple; the core of the Porcupine mountains is hard quartz-porphyry and felsite, rocks more resistant than the interstratified traps and detrital rocks of the main trap range. From the Quincy rockhouse on a clear day the eye sweeps from the Porcupine mountains on the southwest to the end of Keweenaw Point, to the northeast, that is, over the entire 120

miles, and to the northeast Isle Royale may been seen. Again ignoring the immediate foreground, there is an impression of almost absolute horizontality, with the exception of the Porcupine mountain mass, to the southwest, and of some peaks on the south side of the main range far out toward the end of Keweenaw Point to the northeast. These northeastern monadnocks are supposed to be parts of the Gratiot Bluff, Mount Bohemia, and Mount Houghton range, which is known to consist of hard quartz-porphyry and felsite.

The immediate foreground both at Rockland and at the Quincy mine is exceedingly rough, and these two places are typical of the range. When traversed the range is found to be cut by steep ravines, to be carved into bluffs and hills, and everywhere one is ascending or descending. The apparent plain is evidently composed of the higher points of the range, which rise just about to the altitude of the ancient baselevel. Scarcely a remnant of the plateau which once must have existed is left. As determined from the topographic map of the outer part of Keweenaw Point, made by the United States Lake Survey, the Lake Superior baseleveled area is at an elevation of about 1350 feet. The culminating points from near Eagle Harbor east run as follows: 1349, 1344, 1292, 1330, 1312, 1335, 1330 feet. The last is East Bluff, and this is only about 4 miles from the end of the Point. Upon account of the northwest dips these and most of the other bluffs of the district have comparatively gentle slopes in that direction and steep slopes to the southeast where the layers are broken across. Such a remarkable uniformity as given above in the height of peaks carved from tilted rocks of varying hardness could not be the result of erosion of an elevated area. The only satisfactory explanation yet offered for such phenomena is the standard one of an elevated, baseleveled plain which is undergoing a second cycle of degradation. The culminating points of the south part of the range which rise above the baseleveled area are as follows: A point about 3 miles south of west from Gratiot Bluff, 1534 feet; Gratiot Bluff, 1435 feet; Mount Bohemia, 1469 feet; Mount Houghton, 1429 feet. These points therefore rise from 100 to nearly 200 feet above the baseleveled area. According to Irving, many of the ridges of the Porcupine mountains have elevations of 1600 to 1800 feet, while but small parts of the lower portions are as low as 1400 feet. This places the higher points of the Porcupine mountains from 250 to 450 feet above the baselevel.

For the greater part of the area the present cycle of erosion is evidently at its full maturity, and for the outer part of the Point, from which the altitudes above given are taken, just past that stage.

The Potsdam sandstone to the southeast and the upper division of the Keweenawan to the northwest of the main trap range, on account of their softness, are everywhere cut below the ancient baseleveled plain. These areas, unlike the trap range, are in large part so nearly reduced to the level of Lake Superior as to show very much less irregularity of surface than the main trap range. Although cut by river valleys and ravines, and although there are slopes everywhere and in many places very considerable irregularities of surface, the comparative flatness, as contrasted with the Keweenawan rocks of the main trap range or with the Huronian and Archean rocks to the south, is very marked.

A cursory glance at the maps of the district in question shows that when topographic maps of the entire area are made, and its drainage studied, numerous interesting features will probably appear. The trap range is traversed by the stonger streams, such as the Presqu' Isle, the Ontonagon, the Fire Steel and Flint Steel rivers, and Portage

Lake, but the majority of the smaller streams flows to the north and to the south from the central trap area, and they are thus consequent.

The west branch of the Ontonagon river flows from Agogebic lake along the southeast border of the trap range for 20 miles or more. Here it joins the other main branch and the river breaks directly across the trap range in a southwesterly direction.

The only transverse cut where the trap range is reduced almost to the level of Lake Superior is at Portage Lake, and this place has been utilized for a ship canal. From Portage Lake the banks rise steeply from 500 to 700 feet, nearly to the baselevel above. No explanation for this exceptional reduction has been offered. One is tempted to believe that here must have been unusual fracturing or faulting, and this idea is encouraged by the presence adjacent to Portage Lake of a number of important copper mines on the amygdaloids. It is well known that the amygdaloid mines occur where there has been much crushing of the porous rocks, as a result of the differential movement between the layers of trap. A partial explanation of the Portage Lake gap may be the comparative narrowness of the range at this point, as a result of steeper dips. This increased steepness of dip implies greater accommodation between the layers, and therefore more fracturing of the rocks.

The Little Montreal river, which rises on the trap range, flows in a nearly east and west course for 15 miles in one of the softer divisions of the Keweenawan series between two harder divisions, before turning abruptly to the south and breaking through the porphyries, felsites, and traps. Had it continued four miles farther, in a course little south of east, it might have reached Lake Superior at the end of Keweenaw Point without breaking through the resistant formations. A close examination of Irving's Plate XVII. of Monograph V. referred to shows many other interesting points in reference to the drainage.

In a recent number of SCIENCE, July 17, 1896, I described a central Wisconsin baseleveled area, more nearly perfect than that at Keweenaw Point. From center to center of the two districts is about 150 miles. The central Wisconsin district has not been so deeply dissected as Keweenaw Point, but this is readily explained by the fact that it is not so near either of the Great Lakes, and therefore erosion has not so thoroughly stretched its fingers over it. The central Wisconsin baseleveled plain is at an altitude of about 1450 feet. The Keweenawan baseleveled plain is at an altitude of about 1350 feet. Therefore the baseleveled areas of the two districts are probably but parts of a far more extensive baseleveled region.

The area intervening between the two districts consists of Huronian and Archean rocks. Resistant quartzites and mica-schists are characteristic rocks of the Huronian, and gneissoid granite is the dominant rock of the Archean. Since the most resistant rocks were not reduced to the sea level at Keweenaw Point or in central Wisconsin, one would expect that the more widespread, equally resistant rocks of the Huronian and Archean would also project above the baseleveled plain. As a matter of fact topographic maps of the Marquette and Penokee districts made by the U. S. Geological Survey, and under my own direction of the Michigamme district southwest of the Marquette district, show that extensive tracts of country are at altitudes from 1600 to 1800 feet or more, thus verifying the expectation. The variations of level of the ancient uneven plain throughout the region, however, are probably not so great but that Davis's term peneplain may not properly be applied to it. So far as I know, H. L. Smyth was the first to call

attention to this fact for the Michigamme district.

In my previous article I suggested that the period of this ancient denudation was Cretaceous, and gave reasons for the belief that the predominating agent in the process was sub-aërial erosion.

C. R. Van Hise.

CURRENT NOTES ON PHYSIOGRAPHY.

SAN FRANCISCO PENINSULA.

The geology of the San Francisco peninsula by Lawson (16th Ann. Rep. U. S. G. S.) closes with a chapter on its geomorphy, in which it is shown that two fault blocks—San Bruno and Montara, the first more carved than the second—dominate the form of the region. The bounding faults trend northwest, and the fault scarps faced southwest. After faulting and well advanced dissection, a progressive emergence of the two blocks in unison revealed marine terraces at various levels on their flanks. Recently a slight submergence has drowned the lower stretches of the valleys, the Golden Gate being then made a waterway. An effective colored relief map, photographed from a model, brings out the topography very clearly.

TURKEY LAKE, INDIANA.

A biological study of Turkey lake, Indiana, under the direction of C. H. Eigenmann, of the Indiana University Biological Station, gives many details concerning outline, depth and temperature (Proc. Indiana Acad. Sci., V., 1895) that may serve as typical for the smaller morainic lakes of the prairie States. For dimensions the surface is five and a-half long by about a mile wide, with a perimeter of over twenty miles and an area of 5.66 square miles. Soundings have shown the bottom to be of rolling morainic form, like the adjacent county. The greatest depth is nearly 70 feet; the average depth, 17. Small natural changes have occurred in depth or outline, except for the conversion of shallow marginal water into swamps. The catchment basin being small, it is estimated that only seven inches of water are drained off through the outlet, while thirty inches pass away by evaporation. The action of ice in forming beaches is described, following Russell.

GEOLOGY AND SCENERY OF SUTHERLAND.

This attractive little book of a hundred pages by H. M. Cadell, now appears in a second edition (Edinburgh, Douglas, 1896) and gives us northern Scotland in a nutshell. Although chiefly occupied with geological structure and succession, and with diagram and experimental illustration of the 'secret of the highlands,' due attention is given to the topographic forms characteristic of each formation. The bold mountains of nearly horizontal Torridon sandstone, of which the superb Suilven is among the most striking, are benched and cliffed around by the harder layers, and seem to bear witness to the long undisturbed attitude of these ancient strata; but they are neatly shown to have recovered from a tilted position into which they were thrown in pre-Cambrian times. Eight page plates, a dozen figures, an orographical and a geological map illustrate the text.

GEOGRAPHY IN THE ENGLISH UNIVERSITIES.

Sir Clements Markham, in his recent annual address to the Royal Geographical Society, announces that the geographical readership at Oxford, subsidized for ten years past by the Society, will be continued by the University without outside aid; the position still being held by Mackinder. Oldham, at Cambridge, has a less assured position, the subsidy there being still continued. Herbertson, at Manchester, is not mentioned, as the Society has not given a subsidy there. It is proposed that a London School of Geography of university rank should be formed under the