VARIATIONS OF GLACIERS.

TO THE EDITOR OF SCIENCE: At the International Congress of Geologists at Zurich in 1894 a committee, with members representing various countries, was appointed to collect and make observations on the changes which are continually occurring in the length and thickness of glaciers. Much information bearing on the variations of the Alpine glaciers has already been collected, and it is now desirable to know something of the variations of glaciers in other parts of the world, to determine whether these variations are synchronous on different continents and on opposite sides of the equator. To what extent the variations of glaciers are dependent on meteorological changes, and to what extent on the size and shape of reservoirs, etc., is a problem whose solution is hoped for.

Many of your readers will doubtless visit American glaciers this summer, either on the Pacific Coast, in Canada or in Alaska; and I hope they will take sufficient interest in the subject to make observations which will be of value.

The information most desired regarding any glacier is whether it is advancing or retreating. In a memorandum issued by the Alpine Club the following criteria are given:

"When the ice is advancing the glaciers generally have a more convex outline, * * * and piles of fresh rubbish are found shot over the grass of the lower moraines. Moraines which have been comparatively recently deposited * * * are disturbed, show cracks, and are obviously being pushed forward or aside by the glacier.

"When the ice is in retreat the marks of its further recent extension are seen fringing the glacier both at the end and sides * * *; the glacier fails to fill its former bed and bare stony tracts, often interspersed with pools or lakelets, lie between the end of the glacier and the mounds of recent terminal moraines."

For recording the extent of a glacier at the time of one's visit, many methods bave been given. Among the simplest is to measure (or pace) the distance from the end of the glacier to some prominent rock, or to the line connecting two easily recognizable points on opposite sides of the valley. All photographs of the end of a glacier are useful, especially those taken from a station easily accessible and easily described; photographs taken from the same station at a future date will show what changes have taken place in the interval.

Excellent results can be obtained from the following method: Select two stations on opposite sides of the valley a little below the glacier's end; mark and describe them; estimate their distance apart if no more accurate determination can be made; take a photograph of the glacier's end from each of these stations, and determine by compass the angle between the other station and two or three prominent peaks or other features that appear in each photograph. The photographs, the angles and the distance between the stations will be sufficient data to make a rough map of the glacier's end.* All photographs and observations sent to me will be carefully preserved as a part of a permanent record of American glaciers.

Muir glacier, Alaska, is so frequently visited that we should obtain a pretty complete history of its changes. A photograph of the northwestern corner of the inlet, taken from the ship when at anchor, or, better still, from the projecting bluff on the eastern side of the inlet, will greatly help in making the record.

The few observations which have already reached me show that the glaciers about Glacier Bay, Alaska, the Illecellewaet, in the Selkirks, and those on Mt. Rainier, Washington, are retreating.

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JOHNS HOPKINS UNIVERSITY,
BALTIMORE, MD., May 23, 1896.

LIFE HABITS OF PHRYNOSOMA.

PROF. CHAS. L. EDWARDS'S article on the reproduction of *Phrynosoma cornutum* (SCIENCE, May 22, 1896) interested me very much, indeed; but in some respects the article is misleading, as one might suppose from reading it, that Prof. Edwards believes that all the species of lizards of the genus *Phrynosoma* are *oviparous*, as he found *P. cornutum* to be. This is, however, by no means the case, for, as I have pointed out in SCIENCE over ten years ago (September 4, 1885, pp. 185–186), *Phrynosoma douglassii* is strictly viviparous, and its period of gestation

*A fuller account of the desired observations is given in the *Journal of Geology*, Chicago, Vol. III., 1895, pp. 284–288.

is probably about one hundred days. At the present writing I have alcoholic specimens of the young of this species that were given birth to in my presence by a specimen of *P. douglassii*, kept by me in captivity in New Mexico in 1885. R. W. Shufeldt.

May 27, 1896.

BOWS AND ARROWS OF CENTRAL BRAZIL.

Editor of Science: I have just finished reading Dr. Hermann Meyer's 'Bogen und Pfeil in Central Brasilien' (Leipzig, 53 pp., 4 pl. of 67 figs., map), and find it good for sore eyes. His purpose to prepare a much larger work is declared at the outset, and his confession that the shortcomings and sins of collectors and labelers are at the bottom of the ethnographer's disappointments and errors will find an echo in many hearts. Indeed, Dr. Meyer has actually gone to the Mato Grosso to ascertain whether these things that were on his labels are really so.

All bows in South America are self bows. There is not now, and does not seem ever to have been, a made-up bow south of the Caribbean Sea. For the most part, these southern bows are very large, only in Guiana and the northwestern lands, as well as in the far south, in the Gran Chaco, on the Pampas and in Tierra del Fuego, are smaller forms in use. Quite contrary to Ratzel's observations on Africa, the powerful bows are to be found in forest regions, while the smaller ones are in the open.

In the central region studied by Meyer there are five types of bow, to wit:

1. The Peruvian, with rectangular long elliptical cross-section. The material is the heavy, black Chonta palm wood.

2. The North Brazilian, with semi-circular cross-section and made of a reddish brown leguminous wood.

3. The small Guiana bow, with parabolic cross-section, and often with a channel down the back. They are made of a dark brown wood. There are intermediate forms between 2 and 3.

4. The small Chaco bow, with circular cross-section and beautifully smoothed. Made from the red wood of the Curepay acacia.

5. East Brazilian bows of a variety of woods. There are two varieties, the eastern and the western; the northern, or Shingu, and the southern, or Kameh, form connecting links between them. The western variety has circular cross-section, is made of strong wood and wrapped with 'Cipo' a Liana bast, used by the Bororo (Tupi). The eastern variety is of black Airi palm wood, in use among the Puri (Tapuya, or Gêz) and Botocudo (Tapuya, or Gêz).

Of arrows, Meyer characterizes six types, all having two feathers instead of three. In North America the Eskimo and several west coast tribes employed two feathers laid on flat, one above, one below. All the interior and eastern tribes seem to have had the rounded or cylindrical nock and three radiating arrows. The South American types are:

1. The East Brazilian or Gêz, Tupi feathering, occupying all east Brazil to the Paraguay and the Shingu. Two, whole, or seldom halved, feathers are laid on to the shaft flat, one above, one below, and seized with thread, filament or Cipo bast. These wrappings are frequently done in beautiful patterns and pretty tufts of feathers are inserted.

2. Guiana feathering, delicate and carefully laid on. Two short, half feathers are laid on and held fast by wrappings of threads here and there. Once in a while a North American arrow has the feathers thus made fast.

A bit of wood is inserted at the butt end for a nock piece.

3. The Shingu sewed feathering. Two half feathers are sewed on to the shaftment through little holes bored through on either side.

4. Arara feathering, two long half feathers held on by narrow bands of thread wrapping. At the butt end the wrapping is in beautiful patterns.

5. Mauhé feathering, like the East Brazilian, two whole feathers are bound on above and below. A neck piece is inserted at the butt end.

6. The Peruvian cemented feathering. The half feathers are first laid on and held in place by a coil of thread or bast from end to end and then covered with some sort of dark cement. This is subdivided into minor groups.

The shaft, the fore shaft, the barbs, the points of bamboo blades, of monkey bones or of wood, all receive minute attention. The most