Knight and himself on the 'Leucite Hills of Wyoming.' This joint paper was given at the Washington meeting of the Geological Society of America.

December 12.—Dr. Julien reviewed a paper in a late number of the *Bulletin de la Société Belge de Geologie* on the origin of the curious granite enclosed in the arkose of the St. Etienne coal basin.

Professor Grabau presented a very interesting paper on the origin of limestones. This was presented at the Washington meeting of the Geological Society of America.

H. W. SHIMER.

DISCUSSION AND CORRESPONDENCE.

FIRST RECORD OF THE POLLACK WHALE (BALÆNOPTERA BOREALIS) IN THE WESTERN NORTH ATLANTIC.

TO THE EDITOR OF SCIENCE: I am in receipt of reliable information that during the season of 1902 four finback whales of a species corresponding to, or identical with, *Balænoptera borealis* Lesson were taken at the whaling station at Rose-au-Rue, Placentia Bay, Newfoundland. This is the first authentic record of this form of finback in the western North Atlantic. The species is called 'Sejhval' (pollack whale) by the Norwegian whalers. Whether the species taken at Newfoundland is really identical with the European species can of course only be determined by examination of specimens.

The species named *B. tuberosa* by Cope, on the basis of a specimen killed in Mobjack Bay, Virginia, may be the same as the Newfoundland pollack whale, but the description of that species is inadequate for a positive determination, and the whereabouts of the type is at present uncertain. It is quite as probable that the Mobjack Bay whale represented *B. physalus* L.

The Newfoundland whale fishery, which was established in 1898, has grown to large proportions. The kinds of whales taken are the humpback (*Megaptera nodosa*) and three species of finbacks, namely, the common finback (*Balænoptera physalus* L.), the sulphur-bottom (*B. musculus* L.) and, as just noted, the pollack whale (*B. borealis,* or an American representative of that species).

According to the figures kindly placed in my hands by Dr. L. Rissmuller, more than 450 whales were taken at the Newfoundland stations during the season of 1902. The number of each kind taken at four of the stations was as follows:

Station.	Sulphur-bottoms.	Common Finbacks	Pollack Whales.	Hump-backs.	Total.
Snook's Arm Station*		79		21	100
Balena Station†	65	31		11	107
Chaleur Station†	60	11		6	77
Rose-au-Rue Station†	5	70	4	9	88
Total	130	191	4	47	372

The fifth station, at Aquaforte, took about 100 whales, mostly humpbacks.

The existence and importance of this fishery are as yet not widely known in the United States. Thus, in the latest number of the *American Museum Journal* (January, 1903, p. 10), in a notice of a probable sulphur-bottom, it is stated that "whalers know this species as the 'finner' or 'finback' (*B. musculus*) and do not prize it, on account of the small amount of blubber and the small size of the whalebone it carries." When it is considered that a sulphur-bottom whale is worth about $1,000 it becomes evident that this statement is hardly warranted.

FREDERICK W. TRUE.

U. S. NATIONAL MUSEUM,
January 6, 1903.

* East coast.

† South coast.

A SECOND BISHOP'S RING AROUND THE SUN AND THE RECENT UNUSUAL TWILIGHT GLOWS.

TO THE EDITOR OF SCIENCE: A glare around the sun merging into a faint smoky red or purple ring 5° to 10° wide, with the maximum color about 30° from the sun, has been observed here during the past two weeks. Mr. Rotch noticed a smoky ring around the sun on one day in August but no further unusual glare or color was noticed around the sun until recently. I first noticed it on the afternoon of December 28 about half an hour before sunset, when it formed a purple ring, or partial ring around the sun, with the maximum color about 30° from the sun. The following note, made on January 9, gives a description as well as I can of the ring as it appears at present.

January 9.—At 9 to 10 A.M. yesterday morning and again at 10 A.M to-day the ring around the sun resembling a faint Bishop's ring was visible. [Bishop's ring was the name given to the ring observed around the sun after the Krakatoa explosion in 1883.] At 10 A.M. a whitish glare surrounded the sun out to about 20°, when it showed a ring of slightly yellow light; outside of this, at a distance of 25° to 30° from the sun, was a ring of faint smoky red or purple light visible out to a distance of about 40° from the sun. From 11 A.M. to 2 P.M. the colors were not visible, but only the whitish glare. At 3 P.M. a faint red or purple again became visible on the outer edge of the glare and grew more distinct as sunset approached. At 4:27 P.M., about two minutes before sunset, the glow seemed to form a broad purple ring about 7° wide and with its maximum intensity about 40° from the sun. At this time, and for several minutes after sunset, the matter causing the glare was visible as whitish striæ within the purple circle, resembling thin cirro-stratus clouds or cirrus haze. The striæ or ripples extended in a north and south direction. [Observations with a nephoscope on the two succeeding days showed that they were moving very slowly from WSW.] Outside this circle of glare around the sun the sky was blue all day without a sign of clouds. After sunset the colored ring became a deeper purple and approached the horizon. At 4:45 P.M. the maximum color was about 25° altitude and there was a fine purple twilight arch in the east. At 4:50 P.M. there was an orange glow on the horizon about 5° wide, as there had been since sunset, and above this was the greenish-yellow ring of striated cloud matter, while above this latter was the outer ring now developed into a bright purple afterglow, extending from about 10° to 25° altitude. At 4:56 the afterglow had partly merged with the glow on the horizon, forming a bright orange glow extending to an altitude of about 13°. After this time the outer edge of the glow gradually approached the horizon, and there was more red in the color. At 5:10 P.M. the glow was about 4° broad and a faint purple tertiary glow was visible with a maximum of brightness at an altitude of about 20°. At 5:15 P.M. this glow was brighter, with a maximum about 15°, while the glow on the horizon was becoming fainter. At 5:20 P.M. the tertiary glow was still visible with a maximum about 10°. After this the color in both glows waned, and all color disappeared from the western horizon about 5:37 P.M.

The sunsets are less brilliant now than they were in November and December, when they reached their greatest brilliancy. On the clearest days during these months the sunset color lasted from an hour and twenty to an hour and thirty minutes after sunset. The maximum brightness and duration was somewhere near the first of December. The succession of colors in the sunsets on clear days has been as follows: (1) An orange glow on the horizon immediately following sunset, lasting twenty to thirty minutes; (2) a purple arch which appeared a few minutes after sunset high up in the sky, with its maximum brightness 30° to 45° above the horizon. As this glow approached the horizon it increased very much in brightness and became more red, usually reaching its maximum brightness about 25 minutes after sunset at an altitude of 10° to 15°, but sometimes continuing to increase in brightness until it reached the horizon, about 35 minutes after sunset; (3) a second faint purple glow which appeared about 40 minutes after sunset between 20° and 50° altitude, and reached the maximum brightness about 50 to 55 minutes after sunset at an altitude between 10° and 20°.

The following note made on December 6, 1902, is typical of the observed changes.

December 6.—4:12 P.M., sunset; 4:20 P.M., orange glow on horizon, faint purple glow over most of the western sky down to about 15° of the horizon; 4:25 P.M., bright yellow-red, or orange, on horizon, purple glow getting somewhat brighter; 4:30 P.M., orange glow continues on horizon, the afterglow has changed from purple to pink and is much more brilliant, extending to within 7° of the horizon, maximum brilliancy about 15° altitude; 4:35 P.M., the orange glow continues on the horizon, maximum brightness of the afterglow about 10°; 4:40 P.M., orange glow on horizon growing fainter, the maximum brightness of the secondary glow is at an altitude of 7° and is growing somewhat fainter; 4:45 P.M., primary joined to secondary glow and forms a bright orange band about 6° wide on horizon; 4:50 P.M., bright red band about 3° wide on horizon, with here and there short streams extending toward zenith, a faint purple tertiary glow has appeared at an altitude of about 45°; 4:55 P.M., red glow about 2° wide on horizon, tertiary glow brighter and extending from altitude 20° to zenith, maximum about 40°; 5:00 P.M., tertiary glow bright, with maximum about 20°; 5:05 P.M., red glow on horizon fading, purple tertiary glow still bright, with maximum about 15°; 5:10 P.M., tertiary glow fading, maximum about 10°; 5:10 P.M., reddish glow about 5° wide on horizon lasting until 5:25 P.M., when it began to fade rapidly; 5:30 P.M., red band on horizon about 1° broad and growing faint; 5:35 P.M., reddish glow still visible; 5:40 P.M., glow gone.

The duration of these sunsets was considerably longer than the normal sunsets, and it is probable that they were due to the dust from the West Indian volcanoes.

HENRY HELM CLAYTON.
BLUE HILL METEOROLOGICAL OBSERVATORY.
January 11, 1903.

SHORTER ARTICLES.

SOME CORROSIONS FOUND ON ANCIENT BRONZES.

AT the suggestion of Gen. C. G. Loring, of the Boston Museum of Fine Arts, I undertook, some years ago, the investigation of various corrosions appearing on ancient bronzes. The large collection of Grecian and Egyptian bronzes in the Boston Museum furnishes sufficient variety to make the observations of general value. The results obtained may, therefore, be of interest to collectors and curators of other museums.

The ordinary dark green corrosion or *patina* familiar to every one, and most commonly observed on bronze statues exposed to the weather, consists of basic copper carbonate and is comparatively harmless. On very old statues, especially if they have been buried, two different corrosions have been noticed, which from their appearance may be designated as the *pale blue* and *pale green* excrescences. As will be seen later, both may endanger the life of the bronze, and especially the pale blue is the seat of an active chemical reaction.

The *pale blue* excrescence occurs in blotches all over the surface of the bronze and is especially noticeable in less exposed parts, such as indentations or cavities. It has a very fine powdery appearance and, on account of the ease with which it seems to spread from one bronze to the other, was supposed to be of bacterial origin.* A chemical analysis, however, indicates a different origin of the corrosion. About a gram of the substance was carefully collected and found to consist of 50 per cent. sodium carbonate, 25 per cent. copper carbonate, 25 per cent. sand and a trace of sodium stannate. The large percentage of sodium carbonate leads to the following theory as to the origin of the blue rust: As long as the bronze lay buried in the dry Egyptian soil, no reaction took place; on exposure to a moist atmosphere, however, some moisture condensing gave the carbonic acid of the air a chance to combine with the sodium carbonate, forming acid sodium carbonate. This then attacks the metal, forming copper carbonate and regenerating the sodium carbonate, which combines with the copper carbonate to form a double salt, thus accounting for the blue color. It is easy to see how in the course of time a large amount of metal may be thus corroded. To test the above hypothesis a fresh piece of bronze and some powdered sodium carbonate were exposed for several months to a warm, moist atmosphere. The pale blue excrescence appeared and was identical in all respects with the original rust col-

* Dr. Wm. Frazer, *Nature*, 1898, May 19.