typographical errors and a line omitted by Manget they agree word for word.

The line referred to merely tells us that Count Moritz had added Marcgrave to his expedition as his friend and associate.

There is internal evidence in the sketch in Manget which now clearly corroborates the above, for in the last paragraph the writer refers to "this man of most delightful memory standing to me as an older brother." Now also is made clear the dislike, amounting almost to hatred, of this writer for Piso, who is charged with doing everything in his power to enhance his reputation at the expense of Marcgrave's, calling Marcgrave "my domestic," minimizing his importance as a member of the expedition, his work as a collector and observer of natural objects, and his standing as a scientific man.

Exceedingly unfortunate is it that Christian was never able to carry out his purpose expressed in these words:

> His [George's] Brazilian itinerary, if God will so permit, I shall publish, because it contains an exact description of his voyage to Brazil, together with notes on winds, rains and calms. It will not lack accounts of fishing and hunting with the barbarians, and geographical descriptions and notices of places.

By this is probably meant a publication of George Marcgrave's journals, of which notice is made in the body of Christian's sketch and concerning which all the known facts are given on page 254 of my paper (1912). This, however, he unfortunately never lived to do, for the sketch was dated February, 1685, and he died two years later in his seventy-fifth year.

Of Christian Marcgrave I am able to give only this small but interesting bit of information. In my copy of the "Historia Naturalis Brasiliæ" by William Piso and George Marcgrave (Leyden and Amsterdam, 1648), which bears as a book-plate a coat of arms and underneath the word LAETVAERENNYDT and the name of the maker of the plate, there are on the fly leaf opposite the engraved title page two short handwritten sketches in French, one of Piso, the other of Marcgrave. At the close of that on Marcgrave is found this interesting statement:

> His brother Christian, born at Liebstadt in Meissen, was made a doctor by the Faculty of Medicine at Franeker in 1659, and occupied the chair of pathology at Leyden until death overtook him in 1687. We learn that his two books printed separately were afterwards united and published under the title "Opera Medica Duobus Libris Comprehensa," Amsterdam, 1715, in quarto.

Lower on the same page is found, in the same handwriting as the above, this sentence:

> Cet ouvrage a été vendu 32 francs a la vente des livres de Mr l'heritier.

Franeker is a town in Friesland whose university, founded in 1585, was abolished by Napoleon in 1811. "Cet ouvrage" of course refers to the "Historia Naturalis Brasiliæ." There is nothing whatever to indicate who this "monsieur the heir" was, whether heir of the man of the book plate or of an earlier or later owner.

One more point may be added. In a recent catalogue of Dulau and Co., of London, there appeared in an advertisement of Piso and Marcgrave's work the statement that the figures were engraved by de Bray. No information has been obtainable as to who de Bray was or why he was chosen to engrave these figures. That the work was very poorly done an inspection of the "Historia Naturalis Brasiliæ" shows.

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THE EFFECTS OF THE KATMAI ERUPTION ON MARINE VEGETATION

UNDER an appointment as scientist in kelp investigation in the United States Bureau of Soils[1] the writer visited the coast of southwestern Alaska in the summer of 1913. During June and July the coast of much of the region affected by the eruption of Katmai volcano in June, 1912, was visited. The events attending this eruption have been described

[1] This expedition was a part of the general investigation of the fertilizer resources of the United States carried on under the direction of Dr. Frank K. Cameron, of the U. S. Bureau of Soils.

by Perry;[2] the effects of the eruption as seen in June and July, 1912, by Martin;[3] the composition of the ash that fell at Kodiak by Fry;[4] and the effects of the eruption on land vegetation by Griggs.[5]

The eruption was a violent one and proved fatal to a considerable amount of life both plant and animal. It also modified, at least temporarily, the conditions of plant life on the eastern portion of the Alaskan Peninsula and on Kodiak, Afognak and Shuyak Islands and the neighboring smaller islands.

Katmai volcano is situated toward the eastern end of the Alaskan Peninsula. It is about 24 km. north of the nearest point of Shelikof Strait and about 104 km. southwest of Cape Douglas. The wind was westerly at the time of the eruption so that the regions principally affected were those situated immediately to the eastward.

Of the effects of this eruption on marine vegetation as seen in the two months following its occurrence, Martin says:

> Marine life was affected to a larger degree than would perhaps be expected. . . . Kelp is apparently dead as far as the eastern end of Afognak Island.

Such injury to marine vegetation as was still apparent when the writer visited this region, over a year after the eruption, had evidently resulted from one or more of the following causes: (1) the grinding effect of the floating pumice, (2) actual burial of plants by the deposit of ash, (3) the burial by the ash of rocks which had furnished anchorage for marine algæ, (4) the effect of poisonous gases on plants growing in the littoral zone or whose distal portions are kept at the surface of the water by floats.

[2] Perry, Captain K. W. (U. S. R. C. S.), extract from report, *The National Geographic Magazine*, 23, 824–832, 1912.

[3] Martin, George C., "The Recent Eruption of Katmai Volcano in Alaska," *The National Geographic Magazine*, 24: 131–181, 1913.

[4] Fry, William H., "The Mineral Content of Volcanic Ashes from Kodiak," SCIENCE, N. S., 36: 682, 1912.

[5] Griggs, Robert F., "The Effects of the Katmai Eruption on Land Vegetation."

Of the masses of floating pumice, as seen in August, 1912, Martin says:

> The pumice is being washed into the sea by the combined action of streams, waves and tides. There it forms great floating fields which migrate with the winds and tides and greatly impede the navigation of small craft such as ours. An immense field of pumice . . . visited our anchorage at Takli Island. . . . This visitor came and went under the influence of tidal currents and winds, and constituted a menace which led us to seek a more sheltered nook for our boat. Even this was invaded by the floating rock, which jammed tight around and carried our boat with it when it moved, in spite two anchors and two pieces of pig iron down, and forced us to make fast to a projecting cliff. The floating pumice was twelve inches thick alongside the boat and possibly was much thicker in the center of a large field. Fishermen reported a pumice field dense enough to support a man in Shelikof Strait.

In July, 1913, the schooner from which we were conducting the kelp investigation passed through fields of floating pumice more than 241 km. west of Mount Katmai. Some of these fields were as much as 213 m. long and 15 m. wide. In several places the fields were so dense that we scooped up quantities of pumice with a dip net as our schooner passed through them. Drifts of pumice 20 cm. or more in depth were found in August over considerable areas on the beach of a lagoon opening from Popof Strait in the Shumagin Islands. In the region principally affected by the volcanic eruption we found considerable quantities of pumice drifted up on the beaches but did not encounter any floating fields of it. Reports from residents agree, however, that there were extensive fields in Shelikof Strait, Kupreanof Strait and other waters of the region in 1912.

Undoubtedly the grinding effect of the continued movement by tides and waves of the rough pieces of pumice composing these floating fields must have caused considerable injury to beds of *Nereocystis luetkeana* and *Alaria fistulosa*, both of which species are anchored to the bottom and are provided with floats that keep the distal portion of the plant at the surface of the water.

There are some reasons for believing that the grinding effects of these huge masses of rough pumice would be more destructive to *Nereocystis* than to *Alaria*. The growing region of *Nereocystis* is at the bulb, which floats on the water. It is from this growing region that the stipe elongates at its distal portion and the fronds elongate at their base. Serious bruising of this would undoubtedly kill the plant. *Alaria*, on the other hand, has its growing region near the base and the distal end of the frond is usually more or less frayed and ragged as a result of the action of tides and waves. This kelp has continuous regeneration of the frond from this growing region which is so far below the surface of the water as to be safe from any direct injury by floating materials of any kind, and it is possible that individuals might be still living although portions at the surface of the water looked worn and dead. We found considerable beds of *Alaria* at many places on the south shore of Shelikof Strait and at a few places on the north shore. A bed was found at Cape Atushagvik only about 38 km. from the volcano.

At the time of our visit *Alaria* was much more abundant in the region affected than *Nereocystis*. There were many beds of pure *Alaria*, but there were very few of pure *Nereocystis*. There were only a few cases in which the two species were mixed throughout the bed. These facts can not, however, be taken as indicating that the injury was greater to *Nereocystis* than to *Alaria*, for they were true outside of the region affected by the volcano as well as in it.

A good deal of injury to *Fucus* and other plants growing in the littoral zone may also have been done by the grinding effect of this pumice. It is of course well known that *Fucus* has restorative regeneration of its fronds,[6] but we could not detect that this was any more common in the regions affected by this eruption than it was in other portions of Alaska or of Puget Sound. On several exposed rocks at Russian Anchorage (35 km. from the volcano) we found that practically all of the growing *Fucus* was young, much of it not yet producing spores. Among these young plants were found the harder basal portions of old fronds.

It seems quite possible that the softer portions of these plants had been killed by the grinding of the pumice. On other rocks close by, the growth of *Fucus* was abundant, and the plants were vigorous and in fruit. In addition to *Fucus* twelve genera of Algæ were found in the littoral zone at this point. These were all fairly abundant and were in good condition except that many of the red algæ were considerably faded. This, however, the writer has found to be the case locally at several points in Alaska and in Puget Sound. The genera that we found in the littoral and upper sublittoral zones at Russian Anchorage are *Ulva, Laminaria, Alaria, Agarum, Halosaccion, Callophylis, Hildenbrantia, Corallina, Porphyra, Gloiopeltis*.

The maximum fall of ash resulting from this eruption approximated 139 cm. Some portions of the northern shore of Shelikof Strait received as much as 76 cm. The southern shore of this strait received 51 cm. in some portions, and Kupreanof Strait received from the latter amount down to 18 cm. Wherever this deposit was heavy the result was that the Algæ in the flatter portions of the littoral zone were completely buried. In Kupreanof Strait and in the south shore of Shelikof Strait we saw but little effect of the ash on littoral seaweeds. At Russian Anchorage near Cape Atushagvik on the northern shore the results of the ash were more evident. On a flat beach at that place the covering of ash had resisted the action of waves and tides and occasional bunches of *Fucus* on rocks large enough to reach the surface of this layer of ash was all that was left of the littoral vegetation. Not only had the 1912 crop of *Fucus* been buried here but the 1913 crop had been seriously interfered with by the covering of the stones that would have served for anchorage.

It seems probable that in some places sufficient material has been deposited on the bottom

[6] See Setchell, W. A., "Regeneration Among Kelps," Univ. of Calif. Pub. Botany, 2: 139–168, 1905, and the literature there cited.

to cover the rocks and stones and thus destroy all opportunity for anchorage for kelps. When we lifted the anchor (from a depth of 8 fathoms) at Russian Anchorage it was well covered with volcanic ash.

Fry states that glass predominates in the three samples of ash from Kodiak examined by him. He found also feldspars, muscovite, apatite, hornblende, biotite and "undeterminable particles of what appear to be a ferromagnesium mineral." These three samples represented the three falls of ash that occurred in the few days following the first eruption on June 6, 1912. He says that there "glasses would probably react with the soil water" and that "no substances deleterious to plant growth were revealed by the examination."

The injury to marine plants by gas was probably less than from the causes cited above. The presence of sulphurous fumes in the atmosphere was not confined to the time of the eruption but was noted as late as August 16 at a distance of 350 miles north of the volcano. On August 15 at the mouth of Katmai River Martin notes that during a rain "the drops of water striking the eyes produced sharp pain, and brass and silver were tarnished by the drops." On July 27 sulphurous fumes were evident on board the U. S. revenue cutter *Manning* 193 km. east of the volcano. Vegetation on the volcano itself was annihilated. Martin says that the death line "came practically down to the sea 24 km. from the crater" and suggests a hot blast as the cause of the death of vegetation. It seems improbable that a hot blast or poisonous gases caused any great damage to marine plants.

Human interest in the effect of this volcanic eruption on marine vegetation centers chiefly around the two large kelps—*Nereocystis luetkeana* and *Alaria fistulosa*. These kelps, as Martin has noted, are an important aid to navigation. They are a warning to navigators of shallow water, and in a region where there are practically no aids to navigation except such as nature has provided, these kelps are really important. These two kelps (principally *Alaria*) are universally used by the natives of Kodiak Island and the neighboring islands as fertilizer for their potato gardens, and are in this way of considerable economic importance. The 1912 crop of beach grass and other grasses which are ordinarily used as pasturage and hay for the cows kept in this region was practically all destroyed by the volcano. During the winter that followed the few cattle that were still kept in the region are reported to have lived largely on what kelp was to be had on the beach. To these reasons for local interest in these kelps must also be added the fact that they are now to be considered as a possible source of potash fertilizer.[7]

Information obtained by personal interviews with residents of the region indicates that there was large injury to the 1912 crop of kelp, and that even the 1913 crop was far short of that of the years preceding 1912. It seems that the beds became much thicker later in the season than they were at the time of our visit. A reliable informant reports that in December, 1913, the kelp was practically continuous from Afognak village to Little Afognak village. There were only scattering beds at that place when we visited it in June and July.

The fact that there was, previous to 1913, practically no information as to the relative amount of *Nereocystis* and *Alaria* in the region makes it impossible to say which of these suffered more damage as a result of the eruption. It seems probable that both of these species mature from spores in a single year,[8] so that where there were enough individuals left for "seed" the crop would soon become

[7] Cameron, F. K., *et al.*, Sen. Doc. 190, Sixty-second Cong., second session, 1911; "Possible Sources of Potash in the United States," Yearbook U. S. Dept. Agr., 523–536, 1912; "Kelp and Other Sources of Potash," *Jour. Frank. Inst.*, 176: 347–383, 1913.

[8] On the duration of *Nereocystis luetkeana*, see Frye, T. C., "*Nereocystis luetkeana*," *Bot. Gaz.*, 42: 143, 1906; Setchell, W. A., "*Nereocystis* and *Pelagophycus*," *Bot. Gaz.*, 45: 125, 1908; Rigg, G. B., "Ecological and Economic Notes on Puget Sound Kelps," Sen. Doc. 190, Sixty-second Cong., second session, 179–193, 1911; "Notes on the Ecology and Economic Importance of *Nereocystis luetkeana*," *Plant World*, 15: 83–92, 1912.

normal again unless the environment had been essentially changed.

In the main, the effects of this eruption on marine vegetation were temporary. The burial of rock that had served for anchorage will no doubt interfere permanently in some places with algæ in the littoral zone. It is possible that this same cause may also lessen the production of the two large kelps, *Nereocystis luetkeana* and *Alaria fistulosa,* but the evidence now at hand indicates that these kelps are well on their way toward recovery.

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EFFECT OF LIGHTNING ON A REINFORCED CONCRETE AND STEEL DOME

OWING to the increased use of reinforced concrete for buildings I have thought that an account of the effects of lightning on a metal dome surmounting walls of this construction may be of some general interest and of particular interest to astronomers.

On the afternoon of January 2 last occurred the heaviest thunderstorm in the immediate vicinity of the observatory since I came to Córdoba. The conditions were well marked—the weather had been very hot and sultry for several days, the barometer had been falling steadily and was low. The center of the storm, judging from the clouds and their motions, was not over a mile south by southeast of the observatory. In an area between one and two miles in diameter the clouds were very dark and low and masses of dark scud moved about underneath them.

In nearly all the storms which I had seen here previously the discharges were nearly all between clouds. (Perhaps because most of them occur at night?) In this storm nearly all of the discharges were between the clouds and earth.

Very heavy single flashes of lightning began about $2^h\ 20^m$ P.M. Córdoba time—apparently under the blackest part of the clouds and not over a half mile away. All of these which I saw were discharges between the clouds and earth, as also with only one exception, were all which discharged within a half mile of the observatory.

The direction of motion of this storm, as is usually the case, was from south to north. After some half dozen discharges close to the south there was a heavy one to the northwest about three hundred meters away—then another to the northeast about the same distance.

On account of this being a heavy storm and apparently passing directly over us, I was interested to see what the effect would be on our two new reinforced concrete walls and steel domes sheathed with galvanized iron, and was outside among the central group of buildings and not over 100 feet from the dome in question, one of them in full sight.

A minute or two after the flash to the northeast, mentioned above, there was a general illumination close by, followed almost instantly by the ripping sound of a very close stroke. The interval between the flash and the sound was certainly not over $\frac{1}{10}$ second. To me the sound appeared to be made up of three or four separate discharges blended into one—not consecutive.

I was standing within a few feet of the machine shops in easy hearing of the noise of the machinery. This noise stopped instantly after the flash. The main fuse on the light circuit had been blown twice before the flash, probably by induced currents. It was also blown again at the time of the flash.

Mr. Mulvey was in the underground optical shop at the time and thought there had been an explosion in the shop. He saw a flash and immediately afterward the lights went out. It was later ascertained that one lamp had burned out, which probably caused the flash which he saw in the shop. No other damage was done there. The circuits and machines were carefully examined but aside from the fuses being blown at the pump motor, on the 220-volt alternating current no sign of a spark was found.

The power and light currents were cut off until about 6 P.M., when it was found that fuses had been blown on our lines (which were special ones) just outside the step-down-station, some 400 meters away. No other effects of the storm were noticed in or near this station.