

mountainous throughout, with several smoking craters, without harbors, and uninhabited. Southwest of Siguan lies the island of Amlia, extending from east to west about 30 miles but only 2 or 3 miles in width. A long chain of conical peaks traverses the whole length of the island, but no active craters are known to exist. A few streams empty into the Pacific in the south and into Bering sea in the north, but only one small anchorage exists on the south coast. At the time of its first discovery Amlia contained several villages, but they have long since been abandoned.

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The largest of this group is the island of Atkha. It resembles Oonalashka in shape, but its indentations are less deep and not so easily accessible. Near the north point of the island there is a volcano called the Korovinsky, nearly 5,000 feet in height, and a few miles to the south another rises to almost the same elevation. The Kliutcheva (or Springs volcano), and the third, somewhat less in height, though also covered with eternal snow, is situated near the northeastern extremity of the island, and was named Sarychëf. A few smaller volcanoes are scattered along the gradually-descending mountain range forming the backbone of the island. The northernmost only of these craters is active at the present day, emitting smoke and ashes, but earthquakes and subterranean noises are felt and heard all over the island. The largest indentation of Atkha is on the west side, in the bay of Korovinsky, on the shores of which the principal settlement was formerly located. The old establishment was removed, however, to Nazan bay, nearly opposite, on the east coast of the island. In neither of these bays was the anchorage very desirable, one being exposed to westerly, the other to easterly winds. About midway on the west coast is a sheltered harbor, Banner bay, extending some 5 or 6 miles inland, and separated from a corresponding opening on the eastern coast by a low, narrow isthmus. The mountains in the northern part of Atkha exhibit the only glacial formation known to exist on these islands west of Oonimak. Hot springs are plentiful throughout the interior, and at two or three points the natives report mud craters throwing up liquid masses varying in color from red to green, blue, and a brilliant yellow.

Of the small islands adjoining Atkha in the west but little is known beyond the fact that they are mountainous, uninhabited, and evidently of volcanic origin. The nearest large island is that of Sitkhin, which is round in shape and mountainous, culminating in a snow-covered peak 5,000 feet in height, which was reported by Sarychef as emitting flames in the year 1792, but at present no volcanic action is observed beyond hot springs emerging from the rocks in many places.

To the westward of Sitkhin rises the large island of Adakh, covered with mountains and indented with several bays, of which, however, only two, Kiliulik bay on the west and Shagakh on the east, afford anchorage to vessels. One grand peak rising up nearly in the center of the island was called the "white crater" by the Russians, but at present it seems to be extinct; hot springs abound, however, throughout the mountains and valleys of the island.

The islands of Kanaga and Tanaga, in the vicinity of Adakh in the west, also exhibit a succession of volcanic peaks rising abruptly from the sea, a few of them still smoking and grumbling. Only on Tanaga island is there an anchorage on its western shore, in the bay of Slava Rô.

The small island of Anangussikh, or Goreloi, is situated due west of Tanaga, and consists of one immense peak rising abruptly from the sea, with a circumference of about 18 miles. Several of the Russian explorers estimated the height of this peak greater than that of Shishaldin, or more than 9,000 feet, but no recent measurements to confirm this statement have been made.

Throughout the whole group of the Andreianovsky islands Atkha contains the only settlement; all the other islands, though once populous, now serving only as temporary hunting-grounds.

The next group of islands to the westward, named by the Russians the Rat islands, consist of a mass of small volcanic peaks, with the exception of two of somewhat larger dimensions—the islands of Amchitka and Kyshka. Hot springs are found on nearly every island of the group, but smoking craters exist only on Semiseisopchnoi, of Seven Peak islands, and on Sitkhin; the latter being probably the westernmost active volcano of the Aleutian chain. The only anchorages to be found in this whole group are on the west coasts of Kyshka and Amchitka respectively.

The last subdivision of the Aleutian chain was classed by the Russians as a separate group (the Near islands), and consists of the islands of Attoo and Agatoo, the latter situated a short distance southeast of the former. The formation of these two islands seems to be very similar to those to the eastward, but no volcanic phenomena have been observed here within historic times. On the northeastern coast of Attoo the only settlement is situated on the small sheltered bay of Chichagof, but another anchorage, called Massacro bay, exists on the south coast. The island of Agatoo has long since been abandoned by its inhabitants, and affords no shelter to sailing-craft.

THE VOLCANIC REGION OF ALASKA.

As the best authority extant on the volcanic manifestations in Alaska I use a translation of Dr. C. Grewingk's *Treatise on the volcanic character of certain regions of the Russian possessions*, published in the year 1850, in the Proceedings of the Mineralogical Society in St. Petersburg. Grewingk writes as follows:

We know of no more extensive theater of volcanic activity than the Aleutian islands, the Alaska peninsula, and the west coast of Cook's inlet. Here we have confined within the limits of a single century all the known phenomena of this kind: the elevation of mountain chains and islands, the sinking of extensive tracts of the earth's surface, earthquakes, eruptions of lava, ashes, and mud, the

hot springs, and exhalations of steam and sulphuric gases. Not only does the geological formation of most of the islands and a portion of the continent point to volcanic origin or elevation, but we have definite information of volcanic activity on twenty-five of the Aleutian islands. On these islands forty-eight craters have been enumerated by Veniaminof and other conscientious observers, and in addition to these we have on the Alaska peninsula four volcanoes, two on Cook's inlet, one on Prince William sound, one on Copper river, and one in the vicinity of Sitka (Mount Edgecombe); three other peaks situated between Edgecombe and the Copper river have not been definitely ascertained to be volcanic. The distance from the Wrangell volcano, in the vicinity of Copper river, to the Sitka island is 1,505 nautical miles. We have every reason to believe that the Near islands (the westernmost of the Aleutian group) are also extinct craters; and thus we find one continuous chain of volcanoes from Wrangell to the near Commander islands (Bering and Copper), pointing to the existence of a subterranean channel of lava, finding its outlet or breathing-hole through the craters of this region. The nearest volcanoes to the south of this line are Mount Baker on the American continent, in latitude $48^{\circ} 48'$, and the craters of the Kurile chain of islands on the coast of Asia. That a subterranean connection exists between this long line of craters is indicated by the fact that whenever volcanic activity grows slack in one section of the chain it increases in violence at some other point, an observation which has been confirmed by all observers. From all information on the subject at our disposal it appears that the craters of Mounts Fairweather, Cryllon, and Edgecombe, and Mount Calder (Prince of Wales island) have not been active since the middle of the last century, and as the universal law of volcanic activity seems to place the frequency of eruptions in an inverse ratio to the height of the volcanoes, we might reasonably expect that the season of rest for these craters will be a prolonged one; but how ferocious and devastating must be the awakening of the sleeping furnaces when it occurs! With regard to Mount Saint Elias, we have many authentic data as to its volcanic nature. Belcher and Wrangell consider that the black ridges descending from the summits of the mountains, and the fact that the glaciers on Copper river exhibit a covering of vegetation, as proof of the volcanic character of the mountain. The first phenomena may rest entirely upon an optic delusion, as it is not at all certain that the black streaks consist of lava or ashes, while the appearance of vegetation on the surface of glaciers on Copper river is very probably due to the fall of volcanic ashes; the latter phenomenon may be traced as easily and with far more probability to the Wrangell volcano.

With a feeling of relief we abandon this field of speculation and enter upon a review of the volcanic phenomena of these regions in geographical as well as chronological order. All the editions upon which our list is founded came from the reports of the accidental visits of European travelers and explorers. Owing to the low grade of civilization of the natives and even of the colonists it has been exceedingly difficult to collect the necessary information from inhabitants of the country, but such as it is I have made use of all material accessible to me. We first review the volcanic manifestations as far as known in geographical order.

On Prince of Wales island, Mount Calder, located in latitude $56^{\circ} 45'$ and longitude $133^{\circ} 30'$, was active (?) in the year 1775, according to Don Antonio Maurelle; not active in 1793, according to Vancouver, and reported in the same condition by all later observers. On Baranof island we have hot springs, situated in latitude $56^{\circ} 51'$ and longitude $135^{\circ} 19'$, which were reported flowing by Baranof in 1779, and have remained in the same condition. On the mainland we have Mount Cryllon, in latitude $58^{\circ} 45'$ and longitude 137° , reported not active by Cook in 1778. Mount Fairweather, in latitude 59° , longitude $137^{\circ} 30'$, reported not active by La Pérouse in the years 1786 to 1788; Mount Saint Elias, in latitude $60^{\circ} 17'$, longitude $140^{\circ} 51'$, reported not active by Vancouver in 1794, and continued in the same condition. The coast crater on Prince William sound (?), in latitude $60^{\circ} 54'$, reported in eruption by Don Fidalgo; Mount Wrangell, in latitude 62° and longitude 142° , discovered in 1819, and reported active by Kliwosky and Wrangell. The high peak or Rédoute mountain, latitude $60^{\circ} 30'$, longitude $152^{\circ} 145'$ (west coast of Cook's inlet), reported smoking since 1819 by Wrangell and others. Mount Ilyamna, latitude 60° , longitude $153^{\circ} 15'$, reported not active by Bering in 1741 (?) and active by Cook in 1778; also by Don Artsaga in 1779; also in 1768 by Portlock and Dixon; and in 1793 by Vancouver, and also by all later observers, and still continues the same. On the Alaska peninsula the Veniaminof crater, latitude 56° , longitude 158° , reported smoking by Veniaminof from 1830 to 1840; hot springs, in the same vicinity, reported flowing by Veniaminof at the same time, and continue in the same condition; Pavlovsky crater, in latitude $55^{\circ} 24'$ and longitude $161^{\circ} 48'$, reported active from 1762 to 1768 by the promyshleniks; according to Chamisso one of its craters became extinct in 1786, reported active by Sarychef in 1790, also by all later observers, and is still smoking. The craters of Medvednikof and Morshova, in latitude 55° and longitude $162^{\circ} 37'$, reported not active in 1768 and 1769 by Krenitzin, but active in 1790 by Sarychef, now smoking occasionally; hot springs at the entrance of Morshova bay, in latitude $54^{\circ} 34'$ and longitude $152^{\circ} 25'$, were reported flowing in 1832 by Lütke. Hot springs, on the peninsula, in latitude 55° , longitude $163^{\circ} 10'$, were reported by Veniaminof as flowing in 1838; hot springs, on Moller bay, latitude $55^{\circ} 45'$, longitude $160^{\circ} 30'$, were reported flowing in 1828 by Lütke and in 1940 by Veniaminof, and still continue in the same condition. The volcanic island of Amnak, latitude $55^{\circ} 26'$, longitude $163^{\circ} 15'$, was active during the last century, but not active since 1804, according to Krusenstern. On Oonimak island the volcano Khaginak, in latitude (?), has not been active within historic times, though Veniaminof, from native accounts, computed that its crater was formed in the year 1690.

Of the two other volcanoes on this island, Shishaldin, in latitude $54^{\circ} 45'$, longitude 164° , and Pogromny, latitude $54^{\circ} 30'$ and longitude $164^{\circ} 45'$, we have the following data:

In the years 1775 to 1778 the Shishaldin was reported as occasionally active by Zailoof; in 1778 Shishaldin was reported smoking by Cook, and in 1790 by Sauer; it was also reported smoking in 1824 by Veniaminof, and as in full eruption in 1825; in 1826 a new eruption was reported by Veniaminof and also increased activity from 1827 to 1829, and from 1830 to 1831. Pogromny had its greatest activity in the year 1795, and another violent eruption in 1827, and in the autumn of 1830; both are still smoking.

In the island of Akoon a crater, situated in latitude $54^{\circ} 17'$, longitude $165^{\circ} 33'$, was reported by the promyshleniks as not active between 1765 and 1770; in the year 1828 Veniaminof reported it smoking. Hot springs were reported flowing in 1828, and still continue in the same condition. The crater on Akutan island, latitude 50° , longitude $165^{\circ} 54'$, was reported not active in 1778 by Cook, and also by Shelikhof in 1785; it was reported smoking by Sauer and Sarychef in 1790; also by Veniaminof and later observers. On Oonalashka island the Makushin crater, in latitude $53^{\circ} 52'$, longitude $166^{\circ} 48'$, was reported active by Krenitzin in 1768, not active by Cook in 1778, extinct by Sauer in 1790 and 1792, smoking by Sarychef in the same year. In 1802 an eruption, accompanied with earthquake, was reported by Langsdorff; in 1816 and 1817 Eschholz reported it as not active; in 1880 Veniaminof reports earthquakes, and in 1826 an eruption; later observers reported it still smoking. On Oumnak island the promyshleniks reported no volcanic phenomena between 1765 and 1770; in 1784 the Vsevidof crater was still smoking; in 1790 it was reported smoking by Sarychef. From 1817 to 1820 violent eruptions and earthquakes took place throughout the whole Oumnak range. In 1824 and in 1830 other eruptions were reported by Lütke and Postels. The volcanic island of Bogoslov rose from the sea in 1796 with earthquake and eruptions; reported as not smoking in 1800 by Kotzebue; also in 1802 by Langsdorff; reported smoking in 1804 by Kotzebue; in eruption in 1806 by Langsdorff; throwing up stones in 1814 by Baranof; decreasing in height in 1815, also by Baranof; not active in 1816 and 1817, according to Eschholz, and smoking again in 1820, according to Dr. Stein; reported by Veniaminof as no longer smoking since 1823. The volcano on Kagamil island, in latitude $52^{\circ} 53'$, longitude $169^{\circ} 30'$, was reported to have been active by Lütke and Postels. In 1828 Veniaminof reported only hot springs, an exhalation of gases, and subterranean noises. On the island of Tanaga, in latitude 53° , longitude $169^{\circ} 45'$, the volcano is reported not active by Bragin in 1774; in 1828 Lütke reported it active, with many hot springs at its base. The volcanoes of Onliagan and Chogulakh, in latitude $52^{\circ} 53'$ and longitude $169^{\circ} 40'$,

and latitude $53^{\circ} 03'$, longitude $169^{\circ} 24'$, respectively, have not been active since the end of the eighteenth century. The volcano of Unaska, latitude $52^{\circ} 40'$, longitude $170^{\circ} 28'$, was reported smoking in April, 1817, by Choris; in eruption in 1824 by Lütke, and in 1830 by Veniaminof. The volcano of Amukhta, in latitude $52^{\circ} 30'$, longitude $171^{\circ} 04'$, reported in full eruption in June, 1786, by Shelikhof and in 1790 by Sarychef; in 1830 it was reported not active by Lütke, but smoking by later observers. The volcano of Signam, in latitude $52^{\circ} 20'$, longitude $172^{\circ} 12'$, with mud craters and hot springs, was reported active by Sarychef in 1790, and smoking by Lütke in 1827; also by later observers. The five craters on the island of Atkha were reported active from time to time since 1760 by Zaïkof, Tolstykh, Lütke, and others. The Sarychef crater was considered extinct since 1792, but broke out again in 1812, according to Vassiler. The Korovinsky crater was in eruption and smoking in 1820 and 1830. The Kouik peak was reported smoking in 1827 by Lütke; in 1829 by Ingenström; also by later observers.

The volcano on Sitkhan island, latitude $52^{\circ} 04'$, longitude $167^{\circ} 02'$, was reported not active by Tolstykh in 1760, in eruption by Sarychef in 1792, covered with snow and smoking by Ingenström in 1829, also by later observers. The White volcano, on Adakh, in latitude $52^{\circ} 45'$, longitude $176^{\circ} 30'$, was reported active in 1760 by Tolstykh; also in 1784 by Shelikhof; and in 1790 and 1791 by Sauer and Sarychef. The volcano of Kanaga, latitude 52° , longitude $176^{\circ} 50'$, was reported active, with many hot springs at its base, by Tolstykh in 1763, also by Shelikhof in 1768; smoking in 1790 and 1791 by Sarychef, and in 1827 by Lütke, and by later observers. The crater on Tanaga, in latitude 52° , longitude 178° , was reported active from 1763 to 1770 by promyshleniks, and smoking by Sauer in 1791, and by later observers. The volcano on Goreloi, latitude $51^{\circ} 43'$, longitude $78^{\circ} 45'$, was reported active in 1760 by Zaïkof, in eruption by Sarychef in 1792, smoking by Ingenström in 1829. The volcano of Semiseisopochnoi, latitude 52° , longitude $180^{\circ} 15'$, reported smoking in 1772 by Bragin; also by Sarychef in 1790 and 1792; by Lütke in 1830, and by later observers. The volcano of Sitignak, latitude $51^{\circ} 39'$, longitude $181^{\circ} 33'$, was reported active by Bragin in 1776; and finally the crater of Sitkhan, in latitude 52° and longitude $181^{\circ} 30'$, reported smoking by Lütke in 1828.

CHRONOLOGICAL REVIEW OF VOLCANIC PHENOMENA ON THE ALEUTIAN ISLANDS AND THE NORTHWEST COAST OF AMERICA FROM THE YEAR 1690.

Formation of the crater on the highest peak of Oonimak island east of the Shishaldin, probably the Khaginak.

1700 to 1710.—Volcanic activity on the Ouliagan, Chegulakh, and Amnak.

1741.—Ilyamna mountain not active. (†)

1760.—Adakh, Goreloi, Chechina, and Atkha smoking; Koniushy island rising.

1762.—Pavlovsky volcano, on Aliaska peninsula active.

1763.—Volcano on Tanaga active (until 1770).

1768.—The Makushin and another volcano on Oonalashka active; also the Sedvednikof and Morshova on the peninsula.

1770.—Amukhton, active.

1772.—Semiseisopochnoi smoking.

1774.—The volcano on Tannakh-Angunakh active.

1775.—Mount Calder and other peaks on Prince of Wales island active; also one crater on Oonimak island intermittent.

1776.—The volcano on Sitignak in eruption.

1778.—Ilyamna volcano active, and Shishaldin smoking.

1784.—Vsevidof, on Oumnak island, smoking; also the Chechina.

1786.—The volcano on Kanaga in eruption; Pavlovsky crater active; Signam and Amukhta active, the former until 1790, the latter until 1791.

1788.—No volcanic phenomena reported, but on the 27th of July a flood submerged the islands of Sannakh and Ounga and a portion of the peninsula (evidently a tidal wave owing to earthquake).

1790.—Akutan peak smoking; also Vsevidof, on Oumnak, the Kanaga, and Semiseisopochnoi. The Makushin, on Oonalashka, active from 1790 to 1792; and the Shishaldin from 1790 to 1825 (intermittent). Eruption reported on Prince William sound in latitude $60^{\circ} 54'$. (†)

1791.—The peaks of Tanaga and Kanaga, smoking.

1792.—The peaks of Sitkhan and Goreloi in eruption in May; Semiseisopochnoi smoking in June.

1795.—Eruptions in southwest end of Oonimak, while a crater on the north side becomes extinct.

1796.—Appearance of Bogoslov island; Edgecombe active. (†)

1796 to 1800.—Craters on the Four Peak islands active; also Amnak island.

1800 to 1815.—Bogoslov rising, but not smoking.

1802.—Makushin in violent eruption—earthquakes. Bogoslov not active.

1812.—Sarychef peak, on Atkha, very active after a long repose.

1817.—An eruption on the north end of Oumnak with a flow of ashes and earthquake; Unaska smoking.

1818.—Makushin, on Oonalashka, shaking; subterranean disturbances on Amnak.

1819.—Mount Wrangell in eruption; the Rédoute volcano smoking.

1820.—Bogoslov smoking.

1824.—Shishaldin in violent eruption from 1824 to 1825; Unaska in violent eruption after a long repose.

1825.—Eruptions on the northeast side of Oonimak.

1826.—Eruptions and fall of ashes on the south end of Oonimak; the Makushin, on Oonalashka, smoking and shaking.

1827.—The Shishaldin and the Pogromny, on Oonimak, in eruption from 1827 to 1829. The peaks on Koniushy and Kanaga smoking. In June, earthquake on Copper island.

1828.—The peaks of Sitkhan, Akoon, Akutan, Tannakh-Angunakh, Atkha, Koniushy, Goreloi, on Oonimak, smoking.

1829.—Shishaldin smoking; also Sitkhan, Goreloi, Tanaga, Kanaga, and Atkha smoking.

1830 to 1831.—Shishaldin in violent eruption; also an eruption on southwest end of Oumnak and on Unaska; the Korovinsky, on Atkha island, smoking.

1836.—Earthquake on islands of Saint Paul and Saint George.

1838.—Shishaldin in eruption, and three other peaks on Oonimak island smoking; the Tannakh-Angunakh, the Makushin, on Oonalashka, the Akutan, the Pavlovsky crater, and another peak on Aliaska peninsula, smoking.

1844.—The Korovinsky crater, on Atkha, and the Makushin smoking.

From this review, however incomplete, it would appear that the volcanic activity of the Aleutian islands and the Aliaska peninsula has been decreasing since the discovery of those regions by the Russians. When we consider the three classes of manifestations of volcanic activity, that is, eruption, the reduction of sulphuric deposits, and total inactivity, and apply them to the islands mentioned, we find

that in the year 1830 twelve of the islands produced sulphuric deposits, eight islands were in a state of total inactivity, and five (Unaska, Tannakh-Angunakh, Oomnak, Oonalashka, and Oonimak) were in a state of perceptible, though not always violent, uninterrupted activity.

It is also clear to the observer that certain relations exist between the alternate repose and activity at various points along the northern volcanic belt now under consideration. According to the earliest accounts of Tolstykh, Bragin, Zaikhof, Shelikhof, Cook, Sauer, Vancouver, and others, the islands of Sitignak, Kanaga, Amukhta, Kigamil, Bogosloy, Oonalashka, Oonimak, and the volcanoes of the peninsula and the Ilyamna were from the middle to the end of the last century in a state of alternate but generally decreasing activity, while the center of volcanic action apparently advanced from west to east. On Kamchatka, where from 1727 to 1731 the Kluchev was in constant eruption, and in 1737 and 1739 violent eruptions took place from the Avatcha and another volcanic peak, we find only two violent eruptions during the second half of the eighteenth century (of the Kluchev in 1762 and 1767, and of the Avatcha in 1773 and 1796). In 1820 the furnaces of Unaska, Oomnak, and Oonimak evinced renewed activity, while at the same time Mount Wrangell was in eruption. When, however, after this period, the volcanic manifestations on these islands began to decrease, the Kamchatka peaks once more opened their craters with increased violence in the years 1827 and 1829. Of late (1849) we have received no reports of volcanic phenomena on the Aleutian islands, but the Kamchatka craters are once more in eruption since 1848.

These data, vague as they are, do not furnish proof positive of a connection between these subterranean channels, but the fact that within a more limited area, as on the islands of Oomnak, Oonalashka, and Oonimak, the activity of one crater ceased when another was in eruption, points in the same direction.

The Aleutian chain of islands connects the American continent and the Alaska peninsula in the east and the Commander islands in the west as with a knotted cable that has sunk under its own weight and caused its supports or end-posts to converge on both the Kamchatkan and American coasts. Several ranges of mountains run at right angles with this chain or dam. When we look at the outward shape of the islands we find those in the west spreading and flattening toward the north and northwest, and those in the east spreading to the west and south; consequently the lifting force must have been strongest in the direction from southwest to northeast, and this has been the direction of nearly all the earthquakes within historic times.

It seems that three kinds of volcanoes are represented in the Aleutian chain: eruptive, or true volcanoes; intermittent, or partially eruptive volcanoes; and volcanoes that have risen and acquired elevation without an outbreak through the surface. All the volcanoes, with the exception of Shishaldin, have their summits covered with eternal snow. The location of craters on these peaks is as follows: On Shishaldin the crater is located on the summit of the cone; that of Khaginak is on the summit; that of Akoon is also on the summit; on Akutan volcano the old crater was at the summit, and another of later date is situated on the north slope of the peak; the crater of Makushin is located at the summit of the blunted cone; the crater of Vsevidof, on Oonimak island, is on its comb-like summit; the crater of Chegulakh is at the summit of the cone; and that of Unaska is also on the summit of the blunted cone; the Korovinsky volcano has its crater in a depression between two peaks; the volcanoes of Kanaga and Tanaga have their craters at the summit, while that of Sitkhin is located on one side of the conical peak.

A majority of the volcanoes mentioned have their craters at the summit, and should consequently be true volcanoes, but we are by no means sure that all the apertures from which smoke issues are actual craters affording constant communication between the entrails of the earth and the external atmosphere. On many of the island volcanoes the appearance of smoke is due to hot springs or steam arising from cracks or clefts differing very essentially from actual volcanic craters. Where the smoking or steaming is periodical, and increasing in volume during the autumn of the year, we may presume that the constant communication with the volcanic earth beneath exists, since the voluminous atmospheric precipitation at that season of the year would penetrate to the heated strata of the earth and rise as steam from the furnace or crater.

The eruptions reported by the various observers must also be accepted with due caution; in many instances they consisted probably of ignited gases only, as several such eruptions have been described as taking place for prolonged periods on the summits covered with eternal snow. Occasionally the appearance of fire may be traced to the mere reflection of the glow of molten lava in the interior of the crater on the clouds and vaporous atmosphere above. It is true that lava, obsidian, and pumice-stone are found at various points of the Aleutian islands, but we have no description of streams of burning lava, a phenomenon which could not have failed to impress itself upon the mind of even the most careless observer. A few eruptions that have occurred within historic times consisted of ashes, stones, and liquid mud, and they seldom took place in the main craters, being apparently of a subordinate and spasmodic character. We know that sulphur is gathered from many of the craters, but the crystallization of sulphuric gas is among the weakest manifestations of volcanic activity. A majority of the Aleutian volcanoes belong to this class of sulphur-producing clefts and craters.

The falling in of mountains rising on the east coast of Bering sea, the apparent swelling and bursting of whole sections of islands—all these are indications pointing to a constant process of formation of peaks, craters, and crevices by elevation. A gradual rising is still observable on Oonimak island and the north coast of Alaska peninsula. Bering sea at its western end has a uniform depth of a hundred fathoms or more, while the eastern half is very shallow. Another point in favor of the theory that this region owes its origin more to gradual elevation than to violent eruption lies in the fact that the island of Bogosloy was not the result of eruption and piling up of debris or lava, as the island rose very slowly, and its crater was active but a very brief period of time; the elevation continued long years after all other volcanic manifestations had ceased. The only islands actually formed by accumulations of lava during eruptions in Bering sea are Saint Matthew, Saint Michael, and Stuart islands, the Pribylof group, and perhaps Annak island.

CHAPTER IV.—HISTORICAL SKETCH OF ALASKA.

A report upon a country so little known to us as Alaska is at the present day would scarcely be considered complete without a brief historical sketch of its first discovery and subsequent development until its final fusion into the union of states and territories. For this purpose it is unnecessary to go back beyond the second voyage of discovery undertaken by Vitus Bering, who in the course of his first explorations, some years previously, had discovered the strait named after him, and proved to the world the separation of the continents of Asia and America. The so-called second northern naval expedition, fitted out in the year 1733 by order of the empress Anna, though unfortunate in nearly all its details and fatal to its commander, served to show the Russian navigators the way to unknown regions of North America and adjoining islands. The information brought back by members of the expedition, however vague and unsatisfactory, acquainted the Russians with some islands the existence of

DEPARTMENT OF THE INTERIOR,
CENSUS OFFICE.

FRANCIS A. WALKER, Superintendent.
Appointed April 1, 1879; resigned November 3, 1881.

CHAS. W. SEATON, Superintendent.
Appointed November 4, 1881.

REPORT

ON THE

POPULATION, INDUSTRIES AND RESOURCES OF ALASKA.

Alfred H. Brooks,
U.S. Geol. Survey.

BY

IVAN PETROFF,
SPECIAL AGENT.



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