

Sketch maps and profiles of Bogoslof of dates from left to right as follows: (1) Krusenstern 1826, (2) Cantwell 1884, (3) Dall 1895, (4) Stromberg 1906, (5) Jagger 1907, (6) Camden October 1907. These show the gradual growth of the island, and the lower cut in each case is the view from the south.

## EVOLUTION OF BOGOSLOF VOLCANO

The scientific investigation of our vast American domain of active volcanoes in the Aleutian Islands and the Alaskan Peninsula is the largest task before the Section of Volcanology of the Geological Survey. Gradual advancement of this work is provided for by act of Congress, and during the coming summer Akutan Volcano, which has exhibited frequent activity, will be investigated. Akutan is next to the east of Unalaska (see map Page Four), and just to the northwest of Unalaska Bogoslof has been building up during the last 150 years by processes of squeezing up of lava domes similar to that of Tarumai Volcano (Volcano Letter No. 317).

The gradual enlargement of Bogoslof island from 1826 to 1907 is shown in the succession of maps and sketches illustrated on Page One. Bogoslof is a big cone on the sea floor like Falcon Island and Niuafouu in Tonga, but only the tip of it is building above the waves. Under the ocean it is 6,000 feet high. The group of rocks that make the islet have been enlarging by alternations of rising lava and explosive steam jets, the former making domes, and the latter spreading gravel.

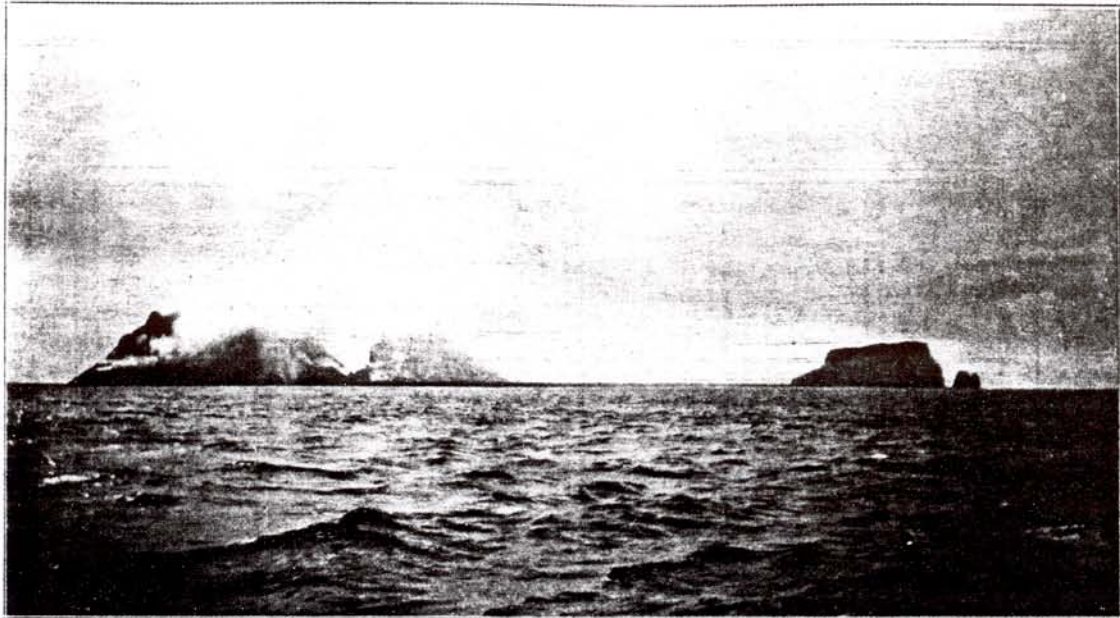
Ship Rock was first noticed by sailor men in 1768. Bogoslof proper or Castle Rock was thrown up in 1796. Grewingk or New Bogoslof rose about 1884 and the older Ship Rock was demolished, but Castle Rock still remained in 1891. In 1896 and 1899 there were two islands with water between. In May 1906 the "Albatross" reported a new volcano Metcalf Cone midway between Castle Rock and Grewingk, and attached by an isthmus to the latter. The cutter "Perry" in July 1906 reported 40 feet of water between the new dome and Castle Rock.

In July and August 1907 the writer visited the islands. A new cone McCulloch Peak had risen south of Metcalf Cone and adjacent to it. Metcalf had split in two showing an andesite horn rising through the split cone. This closely resembled the Pelee spine of Martinique. The rock was hornblende augite andesite with inclusions of sulphides and of diorite, some forms resembling pumice. There were also horn-like processes projecting from the summit of McCulloch dome, which was approximately 450 feet high above the sea. The channel between the islands was entirely filled so that Castle Rock, McCulloch, Metcalf, and Grewingk formed a single island a mile and a half long. McCulloch Peak was nearly surrounded by a steaming salt-water lagoon at about 90° F. and was itself steaming quietly. The following describes the adventures of the writer's party from the schooner "Lydia" of the Technology Expedition (Technology Review Vol. X, No. 1, 1908):

"Wednesday August 7, 1907. At 8 a. m. Bogoslof was in full view ahead, the weather fair, a steady southwest wind blowing. It was determined to land two dories and have the vessel stand off, while three or four hours if possible were spent in examination of the island. (The photograph on Page Two was made from the "Lydia" at this time looking west, and corresponds to the next to the last map of the series on Page One.)"

"The landing was made at 10:30 a. m. Hundreds of immense sea lions, bellowing with voices that well justify their name, swam within a stone's throw of the dories, when they would raise themselves high in the water, stare at the boat, and then plunge frantically beneath the waves. When we landed on the beach, most of the animals there had floundered into the water; but one immense bull re-

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The northern hills and connecting sand bars of Bogoslof Island, looking west August 7, 1907, showing McCulloch dome on the left, Metcalf half-dome, and Grewingk. Castle Rock is out of the picture at the left. Photo Jaggars.

mained, apparently asleep. One of the party ran toward him with a camera, the monster awoke, and with awkward gait flopped down into the sea.

"The hours spent on Bogoslof were the most interesting of the whole expedition. The rocky cliffs are covered with millions of birds, their eggs and their chicks, chiefly murres and herring gulls. On startling them from the face of the cliff of Castle Rock, the swarm of winged creatures literally darkened the air. To members of the party climbing among the rocks the stench from offal and decayed eggs was intense. The island exhibited four rocky hills 350 to 500 feet high, Castle Rock peaked and prominent at the southeast, McCulloch dome circular and steaming actively in the middle, Metcalf crag half destroyed and adjacent to McCulloch on its north side, and Grewingk a flat table rock at the northwest end of the group. These were all connected by continuous gravel and sand strips where a year before there had been a broad channel and seven fathoms of water about the site of McCulloch dome."

"Around the base of McCulloch hill was a lagoon of hot salt water steaming quietly and yellow with iron stained mud. This hill was 450 feet high at the time of our visit, conical in outline by reason of the talus slopes, and showing great lumps or horns of what appeared to be ledge rock jutting out from the upper slopes, while the slide-rock slope of boulders all around the base was straight in profile standing at 30 degrees. The entire mass was steaming from many fissures, and in places there were bright yellow sulphur coatings at the steam vents."

"Metcalf hill was a half-cone with its south side broken down where an explosion had destroyed it prior to the beginning of the welling up of the McCulloch lava. This

rupture left Metcalf with a vertical precipice on the side opposite the remnant of its cone slope still steaming on the north side. Neither Grewingk at the north nor Castle Rock at the south was volcanically active at the time of this visit. The steep cliff of Metcalf revealed in cross section up its middle a great horn of congealed lava, which had risen into the midst of the cone with a smooth curved surface toward the west, and at the top a broken vertical surface toward the east. Seen from the north, this horn looked like a shark's fin or a parrot's beak; seen from the west like the horn of a rhinoceros."

"McCulloch and Metcalf domes were both products of the slow pushing up from beneath the waves of a mass of refractory lava, semi-solid, crusting and breaking into blocks as it rose, with only the central portions retaining a semblance of fluidity. The horns were doubtless such central portions. The same mechanism produced the extraordinary spine which rose 1,000 feet above the dome of Mont Pelee in Martinique in 1902."

"Between 1891 and 1895 Grewingk had changed its form from a large irregular cone to a small flat-topped table. I believe this change was due (1) to its being leveled by the waves and covered with beach deposits, and (2) to its being subsequently uplifted. Beach boulders and sands could now be seen in 1907 on its flat top and in section at the edge of the top of the cliffs. An extraordinary feature of the rocky wall of Castle Rock was a sea cave at the north end surmounting a rock bench or platform 25 feet above the ocean level. This notch and floor had evidently been made by the surf, but the present surf was beating the strand at a much lower level. On comparison with photographs of 1906, a year before, it

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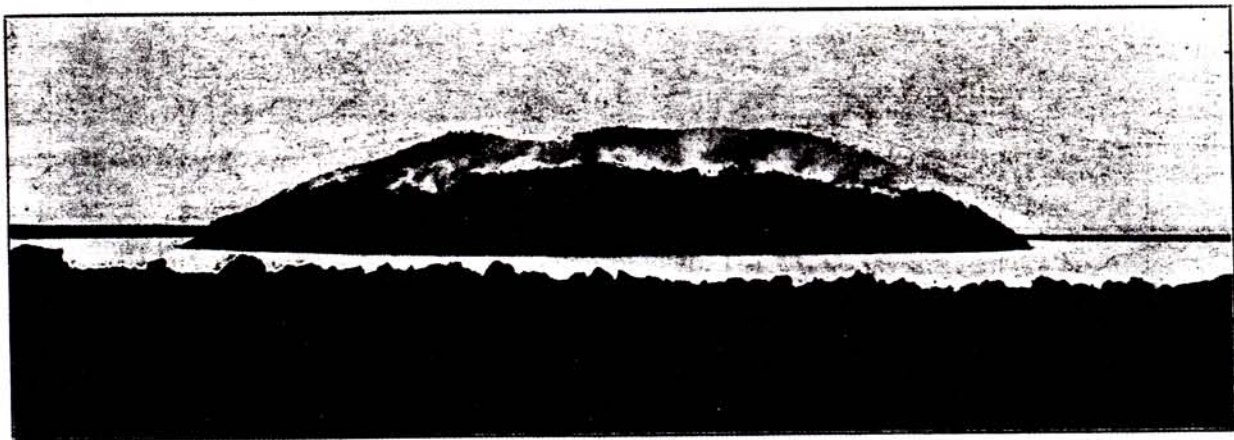
was found that the uplift of 25 feet had taken place during the last year, for those photographs showed the same rock bench and cave at sea level. Evidently Castle Rock had been rising slowly during eight months, while the lava pressure under McCulloch hill was heaping up that dome over 400 feet, with a base measuring 2,000 feet across at the beach level. The effects of mass uplift were in evidence all over the island. While a half plastic lava was pushing up rapidly in the middle cone, the adjacent, older, hard rock summits of the submarine mountain were slowly heaved up."

"On September 1, 1907, after we had left the islands, a steam blast and an engulfment destroyed McCulloch hill, sand and dust fell 100 miles to the eastward, and a visit by the Coast Guard cutter in October 1907 revealed a watery lagoon at the south base of the Metcalf remnant, McCulloch dome was gone, and all of the rocks were shrouded in a heavy mantle of volcanic debris."

There was probably another explosion lowering the remains of Metcalf hill in 1908, leaving a bay surrounded

by beaches between Castle Rock and Grewingk, and in September 1909 two small lava islands arose here, a new lagoon was formed shut off from the sea, and these in June 1910 had united into a single lava hill standing 178 feet above the sea. A true crater was opened by explosion in this hill September 18, 1910, which ceased fuming in 1914. This Tahoma hill, as it was called, had been eroded away in 1922 and a channel was again opened between Castle Rock and Grewingk so that a boat could sail through. Grewingk had diminished in size and Castle Rock was changed to two rocky horns with a big accumulation of sand and gravel piled round about which trailed off into a long sand spit at the north. In July 1926 an explosive eruption heralded new activity, another occurred in December, and then a new lava dome piled itself up in the middle region within a warm salt-water lagoon at 70° F. completely shut off from the ocean by a ring of sand and bombs, and gravel heaps connecting Castle Rock and Grewingk as before. Since that time the island has quieted down.

T.A.J.



New lava heap of Bogoslof Volcano about June 28, 1928, looking southwest showing warm salt lagoon and ring of explosion debris in about the same location as the active domes of 1907. Photo Wheeler.

#### KILAUEA REPORT No. 996

WEEK ENDING FEBRUARY 22, 1931

Section of Volcanology, U. S. Geological Survey  
T. A. Jaggar, Volcanologist in Charge

Halemaumau pit remains very quiet, there is only slight steaming on the south talus, and dust was noticed from slides at the north wall of the pit about 3:10 p. m. February 19.

Eighteen tremors and one very feeble local earthquake were registered at the Observatory during the week, the earthquake at 12:56 a. m. February 20 indicating distance of origin nine miles. Another at 12:26 a. m. February 21 was only a tremor at Kilauea but was felt as a single bumping jolt at Kealakekua in Kona accompanied by a slight noise.

Tilting of the ground was moderate to the southwest at Kilauea, and microseismic motion was slight.