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Preliminary Geologic Map of Great Sitkin Volcano, Alaska

Open-File Report 03–36

U.S. Department of the Interior
U.S. Geological Survey

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U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

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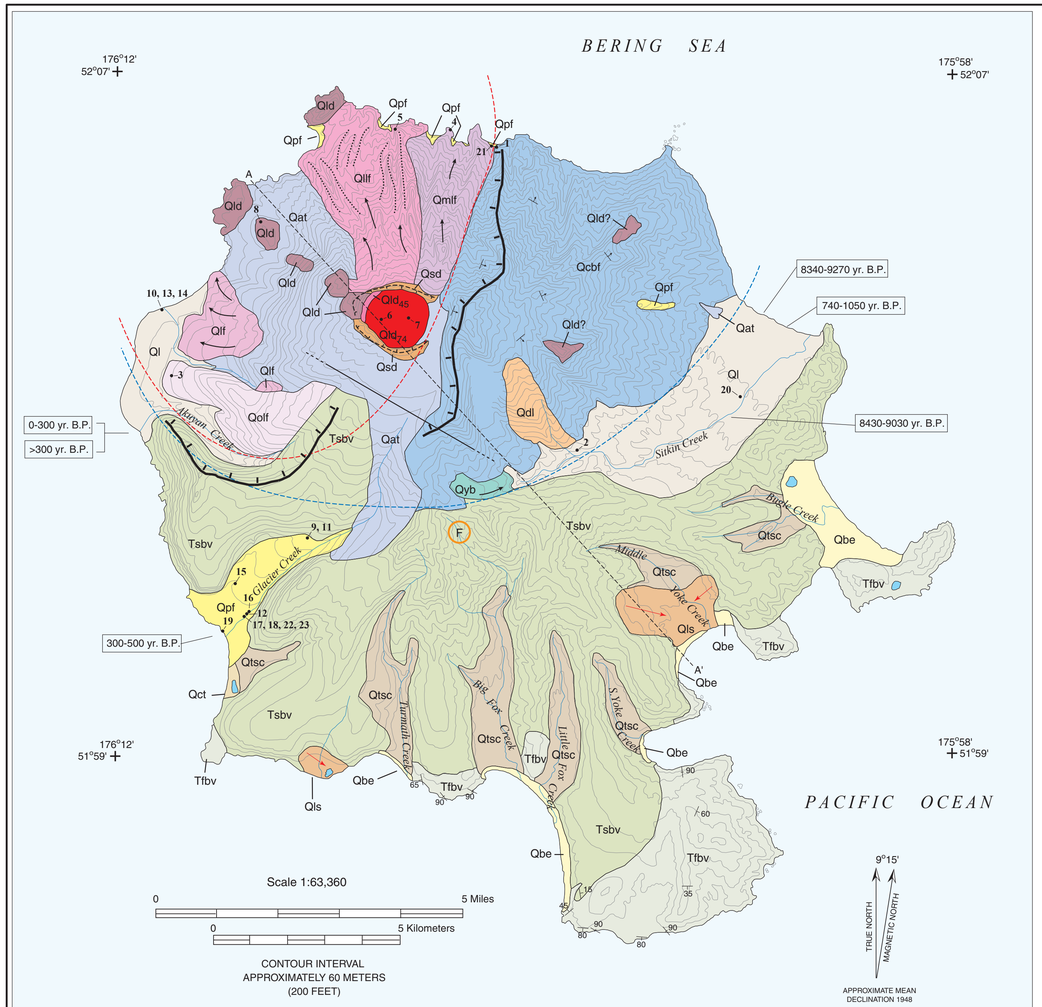
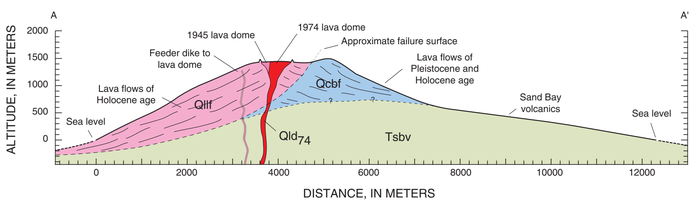




GENERALIZED GEOLOGIC CROSS SECTION

DESCRIPTION OF MAP UNITS

Unconsolidated surficial deposits

Qbe — **Beach and coastal eolian deposits.** Pocket beaches and steep berms of rounded cobble and boulder gravel, and sand. Eolian deposits consist mostly of well-sorted medium to coarse sand.

Qls — **Landslide deposits.** Poorly sorted accumulations of gravel, sand and silt in slumps, and localized debris-flow deposits.

Qct — **Talus and coarse colluvial deposits.** Accumulations of poorly sorted, angular rock debris on hillslopes below bedrock outcrops.

Unconsolidated volcaniclastic deposits

Ql — **Lahar deposits.** Poorly sorted gravel, sand, silt, and boulders in fan-shaped deposits. Present in most major valleys. One to five meters thick. Products of eruptive activity and likely formed when pyroclastic flows and lava flows encountered and mixed with snow or ice on the upper flanks of the volcano. Locally interbedded with pumice-flow deposits; may be overlain by thin amounts of volcanic ash.

Qpf — **Pyroclastic-flow deposits.** Moderate to poorly sorted, non-welded, pumice-flow deposits with rounded to subrounded pumice clasts up to 75 cm in diameter. Ash-rich matrix and abundant angular to subangular lithic clasts up to 25 cm in diameter. Deposits in Glacier Creek valley contain rounded clasts of gabbro up to 1 meter in diameter. Thickness varies but generally between 1 and 10 meters.

Qdl — **Debris-avalanche and lahar deposits.** Poorly sorted, massive accumulations of volcanic rock rubble, sand and gravel. Associated with the older edifice.

Qat — **Talus, avalanche debris and tephra.** Poorly sorted, loose rock rubble derived from fragmentation of lava flows and ejecta. Also includes variable amounts of reworked lapilli tephra.

Qtsc — **Tephra, soil and colluvium.** Accumulations of organic-rich soil, peat and tephra mainly on the southern part of the island. Thickness ranges between 1 and 5 meters. Tephra deposits consist of light colored, fine silt-size ash beds to pebble and granule size lapilli beds mostly derived from eruptions of Great Sitkin Volcano. Colluvial deposits consist mainly of reworked peat and tephra in solifluction lobes or colluvial aprons.

Volcanic rocks of Great Sitkin Volcano

Qld_{74} — **Lava dome emplaced during 1974 eruption.** Dark grey to black, basaltic andesite with highly fractured and blocky carapace. Occupies most of the summit crater.

Qld_{45} — **Lava dome emplaced during 1945 eruption.** Dark grey to black, glassy, porphyritic basalt. Largely removed by 1974 eruption.

Qsd — **Spatter and agglutinate deposits.** Poorly sorted, oxidized, scoriaceous ejecta, bombs and bomb aggregates on the rim of the summit crater.

Qld — **Lava domes of Holocene age.** Medium to dark grey andesite and basaltic andesite that form resistant knobs and hills on the northwest and east flanks of the volcano. Retain little original surface morphology, and blocky exteriors largely removed by erosion.

Qllf — **Lava flows of Holocene age with well developed lateral levees.** Medium to dark grey andesite and basaltic andesite aa lava flows on the northwest flank of the volcano. Characterized by well developed, steep, nearly linear lateral flow levees of blocky aa lava.

Qmlf — **Massive lava flows of Holocene age.** Medium to dark grey, massive, thickly bedded, andesite and basaltic andesite lava flows erupted from the summit crater on the north flank of the volcano.

Qlf — **Younger lava flows of Holocene age erupted from flank vents.** Medium to dark grey andesite and basaltic andesite aa lava flows erupted from flank vents on the west flank of the volcano.

Qolf — **Older lava flows of Holocene age erupted from flank vents.** Medium to dark grey andesite and basaltic andesite aa lava flows erupted from flank vents on the west flank of the volcano.

Qyb — **Basalt lava flow.** Short, stubby flow of dark grey basalt erupted from flank vent at the head of Sitkin Creek.

Qcbf — **Cone building lava flows and volcaniclastic rocks of Pleistocene and Holocene age.** Medium to dark grey, massive, and thickly bedded, andesite and basaltic andesite lava flows, interbedded with thin accumulations of pyroclastic and laharic debris. Makes up the remaining sector of the ancestral edifice that was partially destroyed by flank collapse.

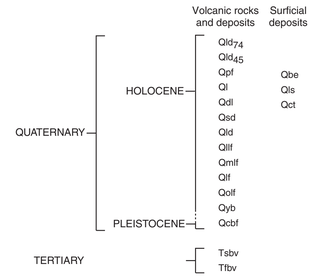
Tsbv — **Sand Bay volcanics.** Undifferentiated agglomerate, pyroclastic rocks, and andesitic and basaltic lava flows. The lower part of the sequence consists mostly of pyroclastic rocks with a few thin flows. The upper part ofthe sequence contains mostly lava flows. These two sequences not differentiated on this map. See Simons and Mathewson, 1955 for additional information.

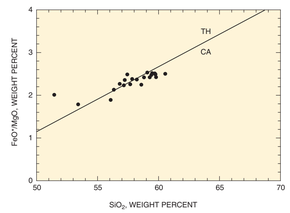
Tfbv — **Finger Bay volcanics.** Undifferentiated andesite and basalt lava flows, flow breccia, tuff and dikes. Deformed and altered to greenstone. See Coats, 1956 for additional information.

EXPLANATION OF SYMBOLS

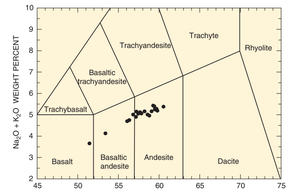
- **Headscarp of flank collapse**
- **Flow direction of lava flow**
- **Lava flow lateral levee**
- **Fumarole area** (F)
- **Flow direction of landslide**
- **Radiocarbon age -** 2 sigma age range of indicated deposit (740-1050 yr. B.P.)
- **Chemical analysis sample location** (see table)
- **Fault-Dashed where uncertain**
- **Contact-Solid where known, dashed where approximately located or inferred**
- **Strike and dip of bedding** (60)
- **Strike and dip direction of bedding**
- **Rim of present crater**
- **Outline of modern edifice**
- **Outline of pre-collapse edifice**

CORRELATION OF MAP UNITS





FeO*/MgO variation diagram for volcanic rocks from Great Sitkin Volcano. Tholeiite(TH)-calcalkaline(CA) discriminant line from Miyashiro (1974).



Total alkali-silica diagram for volcanic rocks from Great Sitkin Volcano. Discriminant lines from LeBas and others (1986).

Chemical Composition of Selected Volcanic Rocks from Great Sitkin Volcano

[Major oxides in weight percent, trace elements in parts per million. Sample labeled Coats is from Simons and Mathewson, 1955. All other analyses by the Geoanalytical Laboratory,Washington State University.]

Map number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Map unit	Qcbf	Qcbf	Qolf	Qmlf	Qllf	Qld_{74}	Qld_{74}	Qld	Qpf	Ql	Qpf	Qpf	Qpf	Ql	Qpf	Qpf	Qpf	Qpf	Qpf	Ql	Qpf	Qpf gabbro inclusion	Qpf gabbro inclusion
Lithology	lava flow	lava flow	lava flow	lava flow	lava flow	lava dome	lava dome	dome	pumice	pumice	pumice	pumice	pumice	pumice	pumice	pumice	pumice	pumice	pumice	pumice	pumice		
Sample #	9M06B	9M15	0M15	0M07B	0M12	9M20	Coats	9M21	0M17B	0NGSSP2	0M17A	0NGS02	00CW04-3	0NGSSP1	0M04	00CW051b	0NGS04P1	0NGS01P1	9M05A	0M18C	9M06A	0NGS01P6	0NGS04P2
SiO_2	58.60	58.82	59.49	56.09	59.73	58.23	57.42	59.81	56.35	56.83	57.17	57.24	57.45	57.69	57.85	59.09	59.29	59.42	59.70	59.76	60.56	51.46	53.42
Al_2O_3	17.74	17.41	17.29	18.17	17.20	17.5	17.12	17.39	18.05	17.68	17.60	17.52	17.85	17.57	17.49	17.33	17.39	17.3	17.45	17.47	17.10	20.09	18.91
FeO*	7.06	7.36	7.11	7.35	7.07	7.49	8.39	6.94	7.71	7.87	7.75	7.83	7.67	7.45	7.65	7.30	6.93	7.01	6.89	6.86	6.64	8.66	8.16
MgO	3.15	3.05	2.83	3.90	2.84	3.17	3.03	2.87	3.63	3.48	3.48	3.33	3.09	3.31	3.22	2.89	2.87	2.84	2.75	2.76	2.66	4.32	4.58
CaO	7.46	7.36	7.02	8.60	6.93	7.49	7.23	6.94	8.42	8.06	8.05	7.84	7.81	7.79	7.65	7.22	7.10	7.02	6.97	6.96	6.64	10.82	9.76
Na_2O	3.69	3.70	3.77	3.33	3.74	3.77	4.17	3.81	3.49	3.70	3.56	3.78	3.69	3.76	3.71	3.71	3.94	3.93	3.80	3.75	3.81	2.78	3.09
K_2O	1.31	1.25	1.47	1.36	1.47	1.38	1.45	1.37	1.25	1.30	1.33	1.36	1.35	1.35	1.34	1.44	1.48	1.46	1.47	1.46	1.56	0.87	1.03
TiO_2	0.65	0.65	0.65	0.78	0.66	0.72	0.84	0.67	0.74	0.73	0.74	0.74	0.73	0.73	0.72	0.67	0.65	0.66	0.63	0.63	0.63	0.72	0.76
P_2O_5	0.16	0.18	0.18	0.24	0.16	0.15	0.24	0.14	0.16	0.16	0.16	0.17	0.16	0.16	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.11	0.13
MnO	0.19	0.21	0.19	0.18	0.19	0.19	n.d.	0.19	0.19	0.19	0.19	0.20	0.19	0.19	0.20	0.19	0.19	0.19	0.18	0.18	0.19	0.17	0.17
Ni	6	2	0	10	0	2	n.d.	0	0	3	2	4	0	3	0	3	0	2	1	0	2	8	11
Cr	15	5	2	22	4	7	n.d.	2	13	12	8	13	8	11	11	9	7	11	5	6	6	18	17
Sc	21	16	14	22	16	29	n.d.	21	31	32	27	23	16	24	18	16	16	27	20	21	20	19	32
V	186	179	155	218	168	202	n.d.	145	235	212	222	197	209	191	199	182	164	156	152	162	142	279	268
Ba	457	460	466	558	486	435	n.d.	446	412	418	437	436	439	432	448	460	476	467	482	475	497	282	324
Rb	28	27	36	34	32	29	n.d.	27	27	28	28	30	28	28	30	32	33	33	34	33	35	17	21
Sr	400	397	368	479	362	369	n.d.	354	381	380	365	375	375	374	371	360	363	364	364	365	351	405	385
Zr	92	95	110	103	113	102	n.d.	108	92	96	96	99	100	101	99	108	111	112	112	111	119	68	78
Y	24	23	25	23	26	25	n.d.	25	23	24	24	25	25	25	26	26	26	27	25	26	27	20	21
Nb	2	3	2	3	2	3	n.d.	3	3	4	2	2	5	3	2	3	3	2	3	3	2	3	4
Ga	19	20	18	17	16	18	n.d.	18	16	19	17	17	16	18	16	16	19	16	18	16	17	16	20
Cu	58	61	69	73	47	66	n.d.	64	58	73	57	35	78	60	38	45	26	65	37	55	34	37	67
Zn	74	82	69	76	80	81	n.d.	82	81	94	78	81	85	89	84	80	79	83	79	84	86	75	70
Pb	7	10	13	8	13	11	n.d.	8	14	13	12	13	15	14	12	16	14	13	14	15	12	9	9
La	13	6	22	19	2	22	n.d.	0	9	7	7	16	36	19	10	3	9	29	17	18	0	10	15
Ce	40	21	29	39	37	37	n.d.	25	5	24	32	29	31	19	54	33	12	26	27	24	31	26	35
Th	0	0	3	7	5	0	n.d.	0	1	2	2	4	4	4	7	6	2	4	0	2	0	1	2

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Base from USGS Adak Quadrangle, 1:250,000 scale
UTM Projection, Zone 1

PRELIMINARY GEOLOGIC MAP OF GREAT SITKIN VOLCANO, ALASKA

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2003

Geology by C.F. Waythomas, T.P. Miller, and C.J. Nye, 1999, 2000; modified from F.S. Simons, and D.E. Matthewson, 1955.

This map is preliminary and has not been reveiwed for conformity with USGS editorial standards or the North American Stratigraphic Code.