

*The Study on Comprehensive Disaster Prevention
around Mayon Volcano*

DATA BOOK

II : SABO PLANNING

1. Description of Historical Eruption in Mayon Volcano

**Attachment Text; Descriptions of Historical Eruptions in Mayon Volcano
(Since 1616 to 1984)**

**Referred by : Newhall,C.(1977) Geology and petrology of Mayon volcano,
southeastern Luzon, Philippines, Master Thesis Univ. California (Davis), 1-292.**

1616 : February. 19-23

The earliest recorded eruption of Mayon Volcano (Spillbergen, 1639) . The eruption was characterized by several “rivers of fire,” thick “smoke” , ash, sand, incandescent materials and bombs. . . Accompanied by violent earthquakes.

1766 : July. 20-25

This was the first eruption to be described at length. Le Gentil (1779-1781) mentioned a “column of fire” 10-15m high, accompanied by a high ash column. Airfall tephra was blown toward the east. At least one pyroclastic flow was described as “falling as a torrent of lava rushing down the east side of the volcano which upon reaching the sea, carried a great display of fireworks.” At least one lava flow occurred, “a river of hot rocks” that poured from the crater and descended the eastern slopes for two days. Crater glow was observed for four months.

1766 : October. 23-24

A destructive non-volcanic lahar was triggered by heavy typhoon rains. The town of Malinao was completely destroyed, and Cagsaua, Budiao, Guinobatan, Ligao and Polangui suffered considerable damage. Coconut and other trees were buried up to their crown. Casualties amounted to 30 in Malinao and 19 in Albay (Legazpi) .

1800 : October. 30-31

Multiple eruptions of ash, sand, and rocks destroyed the towns of Cagsaua, Budiao, and others.

1811 : October. 5-6

Following a series of earthquakes, a forceful ejection of column of ash and rocks, and a “big river of fire rolled” from the summit (Espinosa,1978).

1814 : February. 1

A Plinian eruption, Mayon's most violent and destructive in historical time. A series of locally-felt earthquakes began on January 31, increasing in frequency until the eruption began. Small quantities of ash first appeared on February 1, at 0630H (Martinez,1859); at 0830H, a powerful ejection of ash, lapilli, and bombs "as large as big jars" began. A torrent of fire, lava, and large hot rocks or bombs (Faustino,1929) descended the southern slopes. These hot rocks devastated all the nearby barrios and towns, including Camalig, Cagsaua, Budiao, and large parts of Albay (LegazpiCity) and Guinobatan. Bombs reportedly reached as far as San Miguel Island, 18 km. from the crater, and pumice "as large as hen's eggs" was reported to have reached Bubulusan, Guinobatan. After two hours, ejection of coarse debris, ash and lapilli ejection continued at least 1330H. The ash clouds were dense enough to cause noticeable darkness as far as north as Manila and as far south as Laong, Samar.

Due to the violence of the explosions, the crater rim was lowered by about 40m, and breached on its south side. The sound of explosions was heard as far away as Laong, Samar, and possibly even further. Appearance of "fire" near the crater, earthquakes, and minor eruptions of ash and incandescent materials continued for at least 2 weeks after the main eruption.

Airfall (and possibly surge) deposits formed a widely distributed layer of black, vesicular lapilli and bombs around Mayon, 50 to 100 cm thick near Budiao. Torrential rains were generated within the eruption clouds, and resulting lahars buried the villages of Bubulusan, Cagsaua, and Budiao to depths of 10-12 m. The total death toll for all villages was estimated to be 1200. Large parts of Ligao, Guinobatan, Libog (Sto.Domingo) Tabaco, and Tiwi were reportedly "burned and destroyed," but damage in those areas was most likely from lahars and tephra fall.

1827 - 1828 : June to February

For several days, a column of "fire" rose 300m above the crater, accompanied by a strong earthquakes, lightning in the eruption clouds, and lahars triggered by heavy rains on the southwest slope, especially near Camalig. Thousands were left homeless. The southwest portion of the crater rim was breached.

1834 -1835

This episode was a more or less continuous eruption of incandescent "lava", with a "torrents of fire" going down all the major channels (Abella,1885). On May 5, 1935, this pyroclastic flow (?) activity was succeeded by minor eruptions of ash and lapilli, with great steam clouds and strong

thunder. The airfall was in turn succeeded by numerous lahars.

1839

A minor ash eruption during this year, attributed to Mt. Isarog in Wilkes' (1839-1842) narrative, was more likely from Mayon.

1845 : January. 21 (Abella, 1883) or January. 19-20 (Martinez, 1859)

The eruption began with a small ash ejection lasting for 10 minutes preceded by loud subterranean noises which continued for one week after the start of the eruption (Abella,1883; Faustino,1929) . Explosive pyroclastic eruptions at 15-30 minute intervals followed, which continued for a few days (Abella,1883) . Heavy ash fall, blown by the northeasterly wind, darkened the towns of Camalig, Guinobatan and Ligao. At least one of the ash clouds was mushroom-shaped and contained pumice. Accounts of "red hot sand" (Espinass,1978) and "lava flows running down the ravines" probably refer to pyroclastic flows and subsequent lahars.

1846 – May. 11

This event was a strong ash eruption with clouds of "smoke" overlain by a black cloud of ash (Espinass,1978) . Approximately 12 cm of ash fell on the town of Camalig. Crater glow continued for many nights after the eruption.

1851 : May 26 - June

Two minor ash eruptions, accompanied by violent tremors.

1853 : July 13 - August 26

A major eruption, preceded by loud subterranean noises but not felt earthquakes. At approximately 1100H, an immense column of ash ropes from the crater and spread at its top into a tree-like shape. At the same time, incandescent rocks rolled from the summit to the base of the volcano. Ashfall and probable pyroclastic flows hit Camalig and Guinobatan, leaving them in total darkness and killing about 34 persons (Selga,1937) .

On July 27 a major lahar, as much as 4 m deep in the Nasisi River, changed the course of that river and covered large areas of Ligao, Oas, and Polangui.

On August 26th, from 1400H to 1800H, coarse ash fell in Malilipot, Bacacay, Libog, Guinobatan, Camalig, Cagsaua, and Albay (Legazpi) , leaving them in total darkness for a little over three hours. No mention was made of flows of incandescent volcanic materials, nor casualties.

1855 : March 22

Following crater glow, a minor eruption with incandescent ash, “fire which spread out in the air in the form of very fine threads of gold,” and small intermittent “lava flows.” An earthquake was felt in Manila on this same day (Espinosa, 1978) , but it is unlikely that the earthquake and eruption were related.

1857 : (?)

An ash eruption as reported by Hochstetter (1859) .

1858 : January to December

The initial outburst was lava fountaining which rose up to 150 m above the crater rim. Considerable activity occurred for ten months consisting of quiet flows of lava from the crater, and incandescent materials rolling down the sides of the volcano with emissions of small quantities of ashes at the crater. Entire forests and plantations were destroyed, and many people died from malnutrition and poor sanitation in the evacuation centers. Lahars were reported by Neumann yann Padang (1953) .

In 1858 or 1859, a “pillar‘ (spine) rose just outside the rim of the crater; Jagor (1873) estimated it to be 30-35 m tall, and Von Drasche (1881) estimated it to be 60 m tall. It was subsequently destroyed by the 1892 eruption.

1859 - 1860

During this period, the crater glowed continuously.

1861

A minor ash eruption described by Faustino (1929) as “outbursts of ashes and dust” .

1862

A minor ash eruption with lahars (Neumann van Padang, 1953).

1868 : December 17

An eruption characterized by a large ash cloud and a minor flow of red-hot rocks accompanied by loud subterranean sounds (COMVOL, 1975). Also” thousands of stones, like lighted balloons from the top of Mayon, “ and lahars were reported.

1871 - 1872 : December 8 to January

Early in the morning of December 8, loud subterranean noises were heard, and eruption began between 0700H and 0800H (Faustino,1929), with a high ash cloud that rose “majestically” and then, blown by the northeast wind, spread and showered ashes and accretionary lapilli towards the towns of Camalig and Guinobatan; the ejecta becoming progressively coarser over time. By 1000H, the fields and roofs were mantled with ash to a thickness of 4 mm. At 1300H, the eruption intensified with a strong detonation and volcanic lightning, and “streams of lava” descended south and southeast toward Albay and Legazpi, destroying the 12 years growth of vegetation. Two persons in Bogtong were asphyxiated or suffocated and one person in Buyuan was buried. During the first days of eruption, there were strong earthquakes, and the “sinking of small caves” were reported in Mirisbiris, Bacacay. Pyroclastic eruptions continued for several weeks until January 1872.

1872 : September 5-9

Emission of ash and “lava” , accompanied by subterranean rumblings.

1873 : June 20 - July 22

A minor eruption accompanied by a sudden 30-cm subsidence in the town of Malinao.

1875 : November

No eruption occurred, but heavy rain triggered a lahar that killed 1500 people.

1876 : April and November 26

Minor ash eruptions.

1881 - 1882 : July 6 - August

On July 6, 1881, crater glow heralded a long eruption that began with a thick rain of ash and lapilli, which fell continuously for several days. Floors were covered by 2-3 cm of ash. Following the initial ash ejection, lava was gently extruded from the crevices near the summit. Flows were both incoherent and fragmented, but always incandescent (Abella,1883) .

On July 16 and 22, incandescent rocks described as “lavas” were seen rolling down the gullies of the south and southwestern slopes. From then on, the eruption continued with periods of greater or lesser intensity.

At 1130H, November 21, dark clouds appeared at the summit and ash began to fall in Camalig and Guinobatan. Greater quantities of incandescent fragments descended the slopes, their lines of descent marked by white “smoke” or vapors emanating from the fragments (Abella,1883) (alternatively, the white “smoke” might have been dust). On November 23, 24 and December 2, molten lava and fragmental materials were erupted to the south, southeast, and southwest, reaching 400-600 m below the summit.

Renewed ash eruptions occurred from December 14-January 1882 (ashfall in Camalig and Guinobatan), followed by gentle outpouring of viscous, “fragmented,” incandescent lavas from fissures as low as half way down the south and southwest slopes of the mountain. (Abella,1883) .

Lahars occurred repeatedly throughout most of 1881 and 1882.

1885 : November 21 - December 2

A minor ash eruption, characterized in the record as an “overflowing of lava” toward the SSW, W and SSE slopes, reached only 400-600 m below the crater.

1886 - 1887 : July 8 - March 10

This was another eruption of long duration, gentle, continuous eruption in which lava or “red hot rocks” flowed quietly and slowly from the crater, accompanied or followed by more explosive ash and scoria eruptions on July 8, 1886; February 8, 22 and 27 and March 1 & 9, 1887. On February

22, a moderately large eruption spread ash as far south as Mauraro and brought darkness to Camalig. A stronger ash eruption on March 1 brought darkness again, and on March 9-10 an ash eruption lasting for 20 hours brought up to 8 cm of ash to roofs in Guinobatan and Libog (Coronas,1898 ; Selga, undated manuscript.) Selga also recorded a possible lava flow or pyroclastic flow towards Libog.

Several houses caught fire, the roofs of other houses collapsed and 15 people perished. Lahars began in March 1887 and continued for more than a year.

1888 : December 15

Two minor ash eruptions were accompanied by roaring and rumblings (Faustino,1929).

1890 : September 10-30

Small flows of incandescent material or “lava” were noted on the eastern slopes toward Libog. Then on Sept. 30, a moderately strong ash eruption occurred (Coronas,1898; Faustino, 1929) and flows of molten materials and incandescent rocks almost reached the base near the town of Libog (Faustino,1929) .

1891 : October 3 - 18 and December 3

Minor explosions occurred, and small “currents of lava” flowed down the south and southwest slopes.

1892 : February 3 - 29

By January 1892 the quantity of ash in the plume was greater than usual, and on February 3 crater glow was observed. The eruption consisted of explosive ejection of ash, lapilli, and bombs every 10-20 minutes, accompanied by lightning and subterranean noises. Probable pyroclastic flows “rushed” down the east and east-southeast slopes. On February 20 a large portion of the crater rim broke off, and by February 24 the cone was reportedly lowered by 100 m. Activity waned by the end of the month.

1893 : October 4 - 23 and 31

Premonitory noises were heard on October 2-3. Minor ash, lapilli and bomb ejection, lahars and “creeping lavas” descending the eastern slopes were observed (Faustino,1929). Subterranean

noises were accompanied on October 11 and 18 by strong prolonged tremors.

1895 : July 20 - August, and November 25 - 26

A minor ash eruption and lahar. Lightning, and an “emission of rainwater from the summit, accompanied by underground rumblings and dreadful earthquake.” Crater glow throughout the month of August, and emission of lava from fissures on the east side of the cone during November 25-26.

1896 : August 31 - September 27

This was another period of minor ash and lava eruptions, and minor lahars (Coronas,1898) .

1897 : June 4 - July 23

On May 23 or possibly earlier, premonitory earthquakes, subterranean rumblings and crater glow began. “Dust laden vapors at the summit and small quantities of lava and molten materials” were extruded from fissures near the crater. On May 13, a strong tectonic earthquake along the Philippine Fault Zone that triggered several rockfalls on the eastern (Sto.Domingo) side of Mayon might have hastened the June eruption.

On June 4, the eruption began with a slight emission of ash and incandescent materials, which flowed down the eastern slopes. The emission of ashes and molten materials kept increasing accompanied by incessant roaring and rumblings. On the 23rd of June, a “big mass of dark clouds” was seen, and a “multicolored cloud” or “oson” (pyroclastic flow) descended towards Sto. Domingo, causing Mayon to appear as a “glowing mountain” (M.P.1897). On the 25th, the eruption became even more violent. There were “flames from the crater,” thunder, lightning and flying incandescent stones accompanied by the flow of ashes and sands (probable pyroclastic flows), and some “clouds of ash and dust reached Albay (Legazpi) but only for a short while,” and the glowing avalanche reached as far as the seashore of Sto. Domingo (M.P., 1897) .

Several barrios were completely overwhelmed, as were portions of San Fernando and San Roque. Other “rivers of lava” rushed toward the barrios of Pawa and Bigaa of Legazpi and Tagas of Daraga. At least 226 casualties were caused by the large pyroclastic flow that destroyed the barrios of Sto. Domingo. The total death toll for the days June 25-27, including casualties from other towns, was estimated to be 350. In San Antonio, nearly 10 km from the crater, houses on stilts were completely buried, and field near Sto. Domingo was turned into rock wastelands.

Following the main explosive phase, the ash ejection lasted for 17 hours, from the afternoon of the 25th till mid-day of the 26th. The entire countryside north and east of Mayon was covered by thick, hot ash, with 50 cm in Tabaco, 30-50 cm in Camalig, Libog, Bacacay and Malilipot, and 15-20 cm in Tiwi, Small "pigeon-egg" size lapilli fell in Ligao, but only a few mm of ash fell in Legazpi and Daraga. According to M.P. (1897), ash reached as far as Daet, Catanduanes and Masbate.

A hot lahar passed down the Basud River (Sto.Domingo) just after the eruption, and another hot lahar descended the ENE slope one month after the eruption. Other post-eruption lahars caused major damage in Camalig. The violence of the eruption left a low gap in the east rim of the crater, a gap which persisted until 1947 and which directed several eruptions toward Sto. Domingo.

1900 : March 1-6

Premonitory subterranean noises, crater glow, abnormally high steam emission, slight earthquakes, and abnormal animal behavior were observed in late February. An eruption cloud of ash and lapilli rose 8 km above the crater rim (Faustino, 1929), followed by lava flows, rolling incandescent rocks, terrific explosions from the crater, and flashes of lightning (Selga, undated manuscript). A hot lahar, 750 m wide and 7 m deep flowed slowly down the Basud River and upon reaching the sea, formed large clouds of steam.

1902 :

Minor ash eruption with lahars, or just post-1900 eruption lahars (historical record is unclear) .

1915 :

No eruption occurred, but large non-volcanic lahars or "floods" buried a large part of Camalig and Bongabong, Tabaco.

1928 : January to August

A premonitory column of "smoke" and possible crater glow may have commenced as early as November 1927 (Espinosa, 1978), and was positively seen beginning January 1928. On February 8, short-lived, 150-m high lava fountaining spread pyroclastic debris around the upper slopes of the cone.

Starting June 24, an ash cloud was observed hanging over the summit. On June 25 and 28, July 7, 8, 18, 19 and 21, and August 7 explosive eruptions produced St. Vincent-type pyroclastic flows,

“carbonizing” at least one man in San Antonio, Malilipot. On August 1, ash fell in San Antonio, Tabaco, and in Amtic, Ligao; on another unspecified date, pumice “the size of small oranges” fell in Bonga, Bacacay.

On June 27, at 1840H, incandescent materials were seen rolling down the eastern slope toward Libog, at first “small and tear-like” but gradually increasing in size and frequency. Within three days an aa lava flow had travelled 5 km; slowing, it split into two main tongues at the 450 m elevation. The flow finally stopped in early August, having reached as low as 300 m above sea level. Short lava flows also moved toward Tabaco, Malilipot, Bacacay and Camalig. According to Faustino (1930), the volume of materials erupted in 1928 was around 150 million cubic meters, based upon what was seen resting on the slopes and what the floods had taken away. Further description of this eruption may be found in Faustino (1929).

1930 : March (?)

No eruption, only rain-triggered lahars.

1938 : June 5

A vulcanian eruption, milder than the 1928 activity. Ashfall was heaviest in Guinobatan and Ligao, as much as 3.5 cm thick in Barrio Midela, Ligao. Lesser thickness fell in Camalig, Daraga, and Tabaco. Practically no ash fell on the eastern side of the volcano. Several strong explosions produced small St. Vincent-type pyroclastic flows. An aa lava flow passed through the breached eastern crater rim and flowed parallel to (and just north of) the 1928 flow, to 570 m elevation. Short flows were also reported in the directions of Camalig, Nasisi, Buang, and San Vicente.

1939 : August 21

COMVOL (1975) reported a minor eruption.

1941 : September 13

Minor emission of steam and ash.

1943 :

Another minor emission of steam and ash.

1947 : January 8 - February

Premonitory crater glow and “smoke” was followed by an eruption that began with ash ejection, followed by coarser pyroclastics. On January 9, “lava issued from a fracture at the side of the cone facing Sto. Domingo” (Alcaraz, 1947). On January 10, another lava stream flowed toward Camalig, but the main lava flow descended toward Barrio Calbayog, Malilipot. Probable pyroclastic flows reached near San Vicente, Malilipot.

Continue ash ejection buried Barrio Masarawag, Guinobatan, and ankle deep in ash.

1968 : April 20 - May 20

Premonitory earthquakes as early as October of the previous year (COMVOL,1975), crater glow, occasional subterranean rumbling, “smoke”, a decrease in magnetic field strength in the vicinity of the volcano, and landslides from near the summit in late March to early April announced an impending eruption.

On April 22 (COMVOL,1975), a Vulcanian eruption commenced with falling ash and lapilli, including thumb-size accretionary lapilli, joined later by St. Vincent-type pyroclastic flows toward Tinobran, Quirangay, Miisi, and Bonga (Moore and Melson, 1969). An aa lava flow formed from material coalescing from the lava fountains, and by emission of lava from small fissures within 100 m of the Summit.

Pyroclastic material was emitted intermittently from the central crater - at first, every 3-4 hours and later every 1/2 to 1 hour. Most outburst lasted 10-15 minutes or less, but some were as long as 40 minutes.

Numerous lahars occurred during and after the eruption.

1978 : May 3 to July 4

As early as November 6, 1977, premonitory crater glow was observed, accompanied by change in the color of steam from white to light brown, an increase in the volume of steam emission, and an increase in the frequency of volcanic earthquakes.

The initial activity was Strombolian, with quiet emission of lava and a minimal amount of ash. Rolling incandescent blocks from a lava flow were first noticed on the southwestern slope of the volcano about 2000H on May 3. Concomittant tremor or continuous ground vibration was recorded

by both the Sta. Misericordia and Mayon Resthouse (MRHO) seismographs.

Lava flowed onto the southwestern slope because the crater rim in this sector had been breached during the 1968 eruption. By May 15, the 1968 lava flow was overrun by the new lava.

Lava emission was followed by the ejection of ash clouds, perhaps on May 11 judging from seismic records. By May 15, stronger ejection of cauliflower-shaped ash-laden clouds reached a height of 2.5 km above the crater rim, accompanied by loud detonations and large amplitude explosion type earthquakes, some of which were felt as Intensity I on the ; Modified Rossi-Forel Scale, at the Mayon Resthouse Observatory (MRHO). The eruption intensified until the morning of May 22 when a series of sustained ash ejections were observed. Subsequently, the interval between explosions became longer and the ash ejections relatively stronger. On May 27, three strong ash explosions with seismic signals corresponding to intensities I and II were recorded at MRHO.

Thereafter, the eruption waned, and only slow lava emission continued. On June 23-24, mild ejection of ash was accompanied by rumbling and bellowing sound, a temporary increase in lava discharge, intensification of crater glow, and volcanic tremor and earthquakes. Lava emission stopped by July 4, but crater glow, occasional weak ash puffs, volcanic tremor and earthquakes continued for a few months longer.

About $20 \times 10^6 \text{ m}^3$ of volcanic materials were ejected during this eruption.

1981 : June 30

No eruption occurred, but lahars triggered by heavy typhoon rains killed more than 40 people.

1984 : September 9 - October 6

A slight increase in seismicity (the MRHO) seismograph recorded 36 volcanic earthquakes on August 4) , crater glow, an increase in the volume of steam in the plume and a change in its color from white to brown, inversion of topography in the crater from a depression to a mound, and numerous rockfalls signaled an impending eruption. The eruption began with overflow of incandescent rocks from the crater, followed by Vulcanian explosions, light ashfall, pyroclastic flows, and concomitant lava extrusion, from September 9 until September 16 or 17. During the strongest explosive activity of this first phase of the eruption, ash clouds on September 13 reached heights of 11-12 km above the crater rim, and pyroclastic flows traveled toward the SW and NW. Lava flowed mainly toward the SW, paralleling the 1968 and 1978 flows; short flows also move

NNW and NW.

On September 23-25 a strong resurgence and the strongest explosions of the eruption sent ash clouds to a maximum height of 16 km (Sawada,1985), and generated numerous pyroclastic flows. Most of the pyroclastic flows were funneled by a breach in the crater rim onto the SE and E slopes of the volcano. Repeated flows along the SE path (above Bonga, Legazpi) eroded a deep ravine.

A mild resurgence occurred on October 6. Numerous lahars occurred during and after the eruption.

No casualties were attributed to the eruption or to subsequent lahars. Further description of this eruption may be found in the SEAN Bulletin (1984) and Corpuz (1985).