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THE

VOLCANIC HISTORY

OF

TARANAKI

This booklet should be referred to as:–
V.E. Neall, 1974.
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TABLE OF VOLCANIC EVENTS IN TARANAKI

Age of Event Years before present	Geological period (or yrs A.D.)		Event	
250		1755AD	Tahurangi Ash eruption (Druce 1970)	Debris flows along south side of Ahukawakawa Swamp and down Stony River.
	RECENT	1655AD	Burrell Lapilli eruptives (Druce 1970)	
350				Large flood in Okato region.
		1500AD	Newall eruptions — hot nuées ardentes.	
700			Scattered ash and lapilli eruptions to the east of Egmont summit.	
1,500			Widespread stability.	
3,000	HOLOCENE		Final construction of upper Egmont cone — emplacement (with decreasing age) of Sharks Tooth, Dray Track, Skeets Ridge and Minarapa Stream lava flows.	
			Collapse of south-west sector of Egmont cone to form "amphitheatre" between Bobs Ridge and Fanthams Peak.	
7,000			Eruption of Oakura Tephra. Extrusion of cumulodomes around Egmont, e.g., Beehives.	
			Collapses led to debris flow deposits in upper Newall Road region.	
			Eruption of Okato Tephra.	
10,000			Construction of basal portions of present Egmont cone e.g., West Ridge, Bobs Ridge flows.	
15,000	PLEISTOCENE		Beginning of new Egmont cone — emplacement of Dawson Falls, Warwicks and Humphries Castle lava flows.	
			Construction of Fanthams Peak.	
			Construction of Pukeiti cone.	
35,000			Cone collapsed forming Pungarehu lahar mounds.	
			Construction of an early Egmont cone.	
70,000			Activity at Egmont started — mainly laharic breccias preserved.	
250,000			Pouakai Volcano — diorites and andesites with extensive ringplain of laharic breccias, and eruptions of ashes preserved in New Plymouth region.	
500,000			Kaitake Volcano — andesite, diorite and associated breccias (now hydrothermally altered).	
1.75 million			Paritutu and the Sugar Loaves — dacitic cumulodomes.	
12 million	TERTIARY		Deposition of Tertiary sediments (mudstones, sandstones, limestones and coal) with later folding to produce oil and gas containing structures e.g., Kapuni.	
60 million				

THE VOLCANIC HISTORY OF TARANAKI

Mount Egmont and the ranges extending towards New Plymouth have been built by volcanic activity that has lasted from early Pleistocene times (about 2 million years ago) almost to the present day (see Table 1). Prior to this Taranaki was covered by a shallow sea, (e.g., seashell deposits of eastern Taranaki) beneath which a sequence of sediments was being deposited during the Tertiary period (mainly between 12 and 60 million years ago). Oil and gas within these sediments have flowed into structures which have been subsequently drilled and commercially developed e.g. at Kapuni. The lavas which have been extruded from Mt Egmont and the other volcanoes cover a comparatively small area at high altitudes, and below the 900 m contour they merge into a thick apron of fragmentary volcanic debris called the *ringplain.* Because the latest activity on each volcano destroyed the previous deposits near their source, a complete geological history of the area involves investigations both within and outside the National Park. The outskirts of the Taranaki volcanic ringplains are bounded to the west by the coast and to the east by uplifted Tertiary mudstone country from Urenui south to Hawera.

With time the activity has followed a NNW to SSE trend in Taranaki along an apparent major linear fracture in the earth's crust. Progressing southwards along this fracture each volcano is seen to be associated with a progressively more recent and youthful landscape. From north to south are: (see map, p3)

1. Paritutu and the Sugar Loaves at New Plymouth, positioned slightly to the north-east of the principal volcanic line.
2. Kaitake, a disembowelled extinct volcano.
3. Pouakai, a severely eroded and extinct volcano, and
4. Egmont, a classic volcanic cone of interbedded lavas and *breccias* (coarse angular rock fragments set in a matrix).

This booklet enlarges on the story of Taranaki's volcanic history as told on Panel 3 in the Dawson Falls Visitor Centre. It will also be informative when walking on the Mountain or when driving on roads of the surrounding ringplain. It will help you to recognise features of Taranaki's volcanic history.

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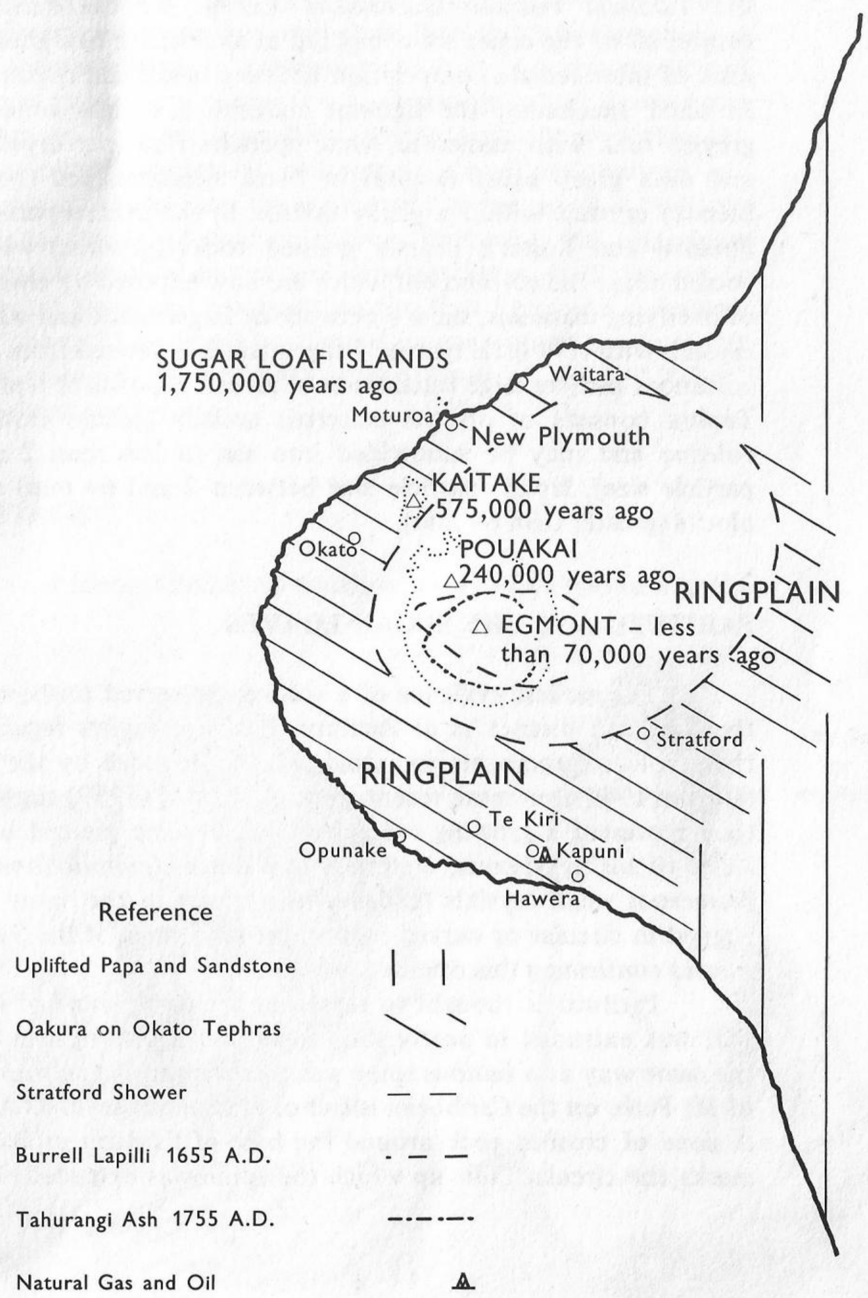
TARANAKI VOLCANIC SUCCESSION



This sequence of linear volcanic activity is referred to as the *Taranaki Volcanic Succession.* Except for the Paritutu centre, all of the cones are composed of *andesite* (a fine-grained rock of intermediate composition between basalt and rhyolite). In hand specimens, the Egmont andesite is a light or dark greyish rock with numerous white speckles (feldspar crystals) and dark green squat (augite) or black needle-shaped (hornblende) crystals within a glassy matrix. In the central parts of Pouakai and Kaitake coarser grained rocks (*diorites*) which cooled inside the volcano but which are now exposed by erosion of overlying materials, show a network of larger black and white crystals with very little matrix. Other materials derived from the volcanoes include large thicknesses of air-fall deposits or *tephra.* Tephra consists of all the materials aerially ejected from a volcano and may be subdivided into ash (if less than 2 mm particle size), lapilli (particle size between 2 and 64 mm) and blocks (greater than 64 mm).

PARITUTU AND THE SUGAR LOAVES

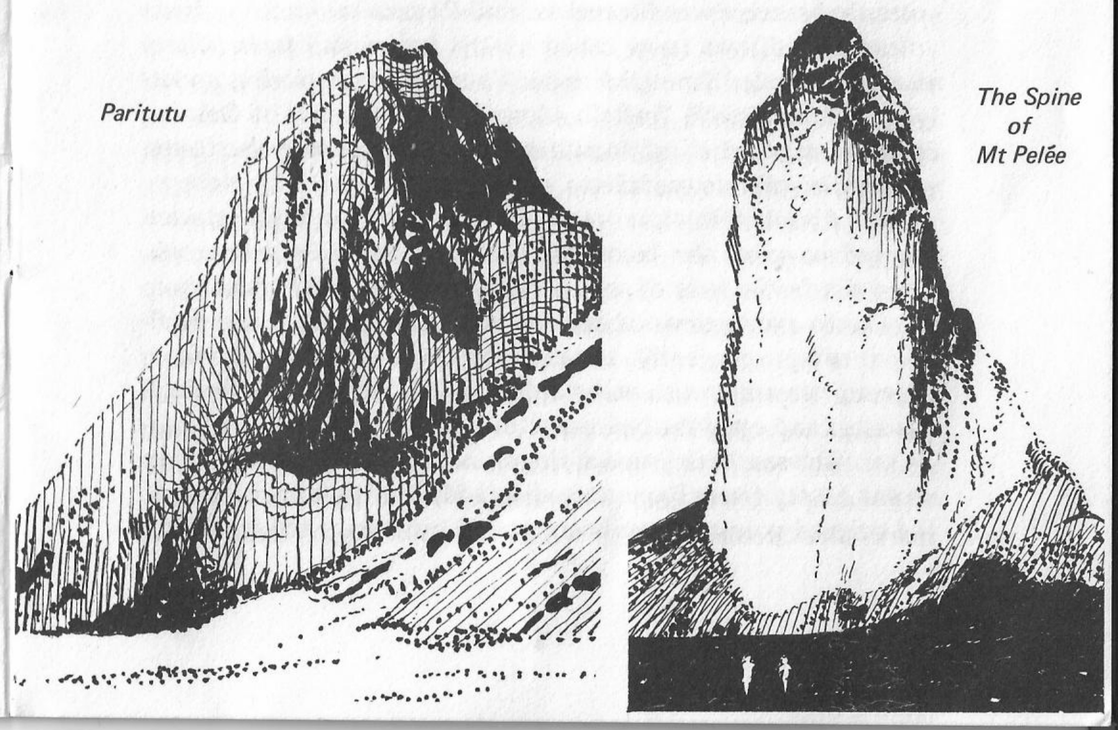
The earliest evidence of a volcano preserved onshore in the Taranaki district is at Paritutu. Early geologists regarded these volcanic remnants as an old volcano denuded by the sea (Hutton 1944), but more recent work by Arnold (1959) suggests they represent a growing volcano which became pierced by a series of highly viscous, craterless lava domes (*cumulodomes*). Numerous small crystals (called *phenocrysts*) in the lavas are aligned in circular or curved patterns around most of the Sugar Loaves confirming this origin.

Paritutu is thought to represent a plug or spine of lava that was extruded in nearly solid form, like a piston, in much the same way as a famous spine was thrust up from the summit of Mt Pelée on the Caribbean island of Martinique in 1902 A.D. A zone of crushed rock around the base of Paritutu probably marks the circular fault up which the spine was extruded. The

rocks have been radiometrically dated at about 1¾ million years old (Dr J.J. Stipp, personal communication). This dating is determined from the amount of time that has elapsed since the rock solidified, by measuring the stage of decomposition of certain radioactive elements e.g. potassium which decomposes to argon. This decomposition proceeds at a known rate and when particular element contents of a rock are analysed and compared to these rates the age is easily computed. It is probably due to these volcanic extrusions fracturing the underlying sediments that oil has seeped upwards along small fissures to form oil seeps and gas vents on the New Plymouth foreshore. For about 65 years oil has flowed in small quantities from this field, yielding some 4,500,000 litres of crude oil and 100,000 m^3 of natural gas per year.

KAITAKE

Fifteen kilometres south-west of New Plymouth is the



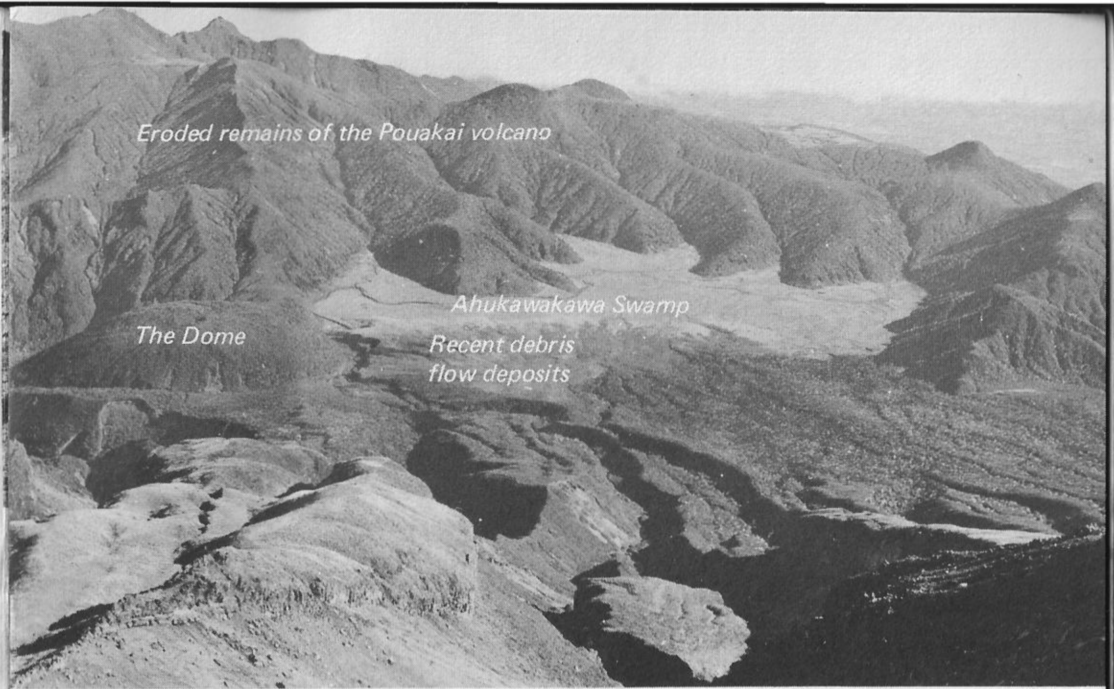
Kaitake Range where volcanic activity began about ½ million years ago (Stipp, pers. com.). Advanced erosion has reduced the volcano to a circular area of radiating ridges which rise to the central point Patuha 673 m in altitude. There is little evidence preserved today of the activity associated with this volcano because most of the rock outcrops are covered in bush. Of the few rocks exposed, most are andesites and diorites. These have become altered by percolating hot solutions to quartz and kaolinite (china clay) with small quantities of pyrite. Gold, silver and copper have been reported from the Boars Head mine on the north-west side of the Range, but the workings were quickly abandoned.

POUAKAI

Ten kilometres to the south-east of the Kaitake Range is the Pouakai Range, an extensive mountainous area rising to 1,377 m, with a diameter of between a half and two thirds that of Egmont. About ¼ million years ago an extensive ringplain of volcanic breccias was formed around Pouakai volcano by huge volcanic mudflows (now called by the Indonesian term *lahars*) which descended from the upper Pouakai slopes prising underlying sediments into "rafts". Along the coast north of Oakura, 30 ft (9 m) "rafts" of fossiliferous mudstones may be found within the volcanic breccias.

About this time most of the Pouakai tephras were erupted covering the landscape with a mantle of volcanic ash, upon the fertile soils of which the productive dairy industry in the Okato and Inglewood regions now depends. Here the landscape comprises gently seaward-dipping interfluves (surfaces between streams) with steep sided valleys entrenched through the ashes and onto the bedrock.

The southern Pouakai ringplain has been eroded by more recent lahars from Egmont and in addition the upper parts of the original volcano have been eroded by stream and ice action



so that only the lower and middle portions remain. In fact during the last period of climatic cooling, 15–20,000 years ago, (the Last Glaciation) many of the tephras covering the upper slopes of the Pouakai Range were eroded and redeposited as dunes and mounds at lower altitudes. These deposits are clearly visible along Carrington Road.

Rocks within the Pouakai Range are mostly columnar jointed andesite flows and some diorites. Within the lava rock one may sometimes find radiating aggregates of hornblende crystals and also foreign rocks (called *xenoliths*) of diorites, schists (highly altered rocks which have suffered high temperatures and/or pressures) and sediments which became incorporated in the lavas as they broke through to the surface. Representative samples of these rocks together with those from Egmont can be easily collected in the beds of Stony and Waiwakaiho Rivers. The large Ahukawakawa Swamp between Egmont and Pouakai was regarded as a *caldera* (a depression generally due to subsidence of a volcano's core region) by Gibson and Morgan (1927) but there is little evidence of any circular faulting to substantiate a collapse caldera origin.

EGMONT

Little is known of when activity commenced at the Egmont centre but some of the oldest deposits are exposed in the coastal cliffs of southern Taranaki, particularly between Manaia and Hawera. Early tephras preserved in the Okato-Oakura region suggest activity at the Egmont centre began 50–70,000 years ago. It appears that a substantial cone had been constructed by 35,000 years ago and that about this time an eruption occurred leading to large scale collapse. The bulk of the cone slid westwards as a huge lahar to beyond the present coastline. Collapses of this type appear to have been a repetitive and common occurrence with the Taranaki volcanoes and much controversy exists as to their cause. Grant-Taylor (1970) has proposed that these eruptions occurred during glacial periods when eruptions pierced large accumulations of ice which rapidly melted and transported vast quantities of volcanic detritus seawards. However, more detailed studies show that some lahars have originated from Egmont during periods of warmer climate too, and it is possible these originated from collapse of a crater lake. To the non-geologist such events are difficult to visualize but similar collapses have been recorded in historical times in Iceland, Kamchatka (Russia), and in Indonesia where lahars have travelled up to 90 kilometres from their source. The 1953 Tangiwai Disaster here in New Zealand was caused by a small lahar generated by partial collapse of Mt Ruapehu's crater lake. Water charged with rock debris swept down the Whangaehu River and washed away a railway bridge as the main express was crossing it, killing 151 people.

The huge lahar deposits in western Taranaki (see map p.15) stretch southward from Okato to near Te Kiri and are typical of lahar deposits throughout the world. In particular they show many thousands of various sized mounds developed on their upper surface. Within most of the mounds is an unsorted, chaotic arrangement of andesite lava fragments with little or no bedding. Elsewhere on Egmont ringplain where

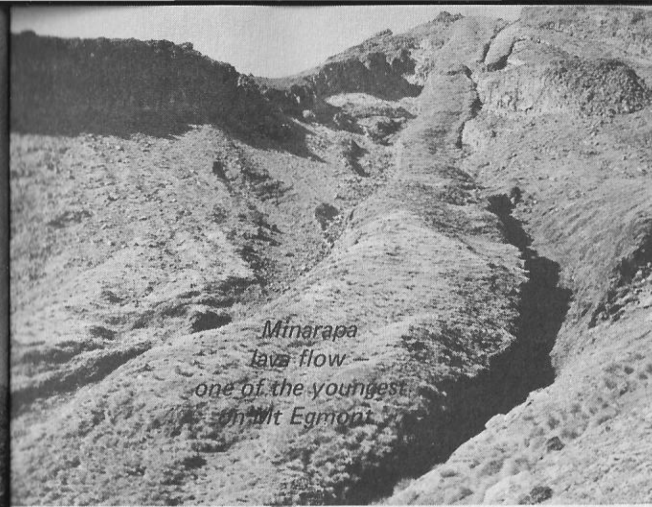
Lahar mounds

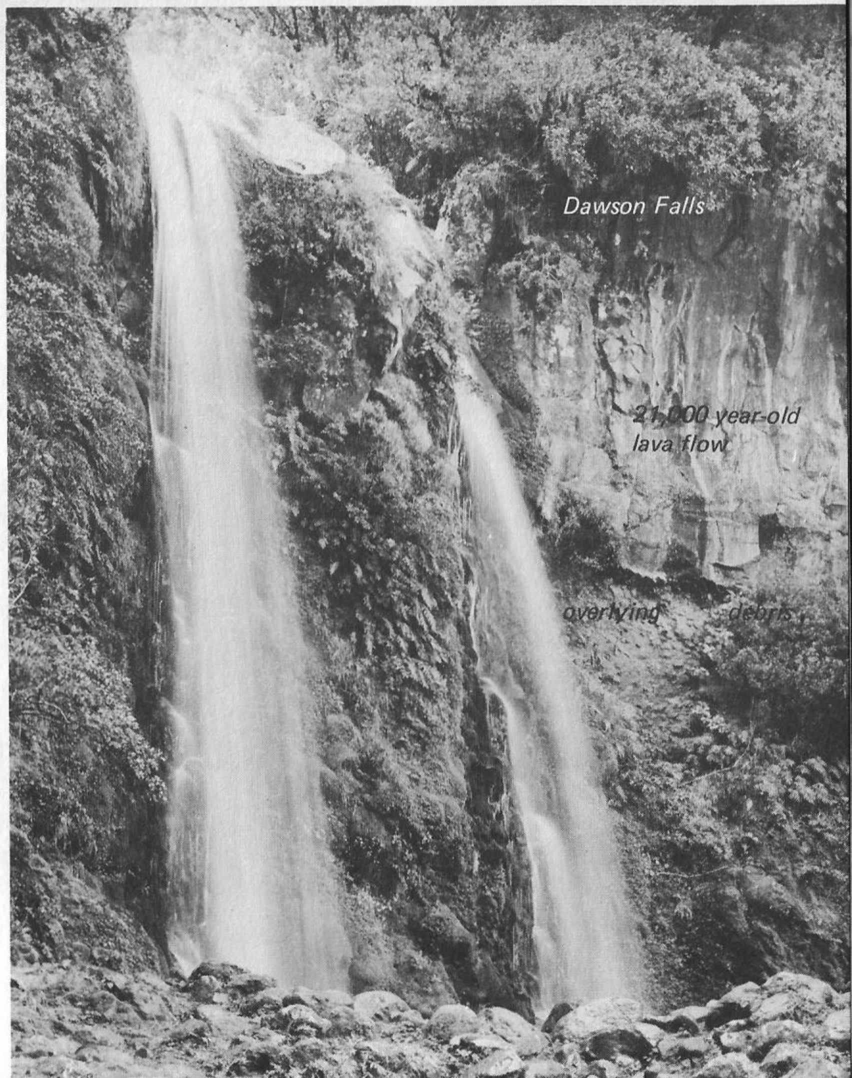
mounds are absent the lahars progressed as a surge of debris charged with water in the manner of a flood.

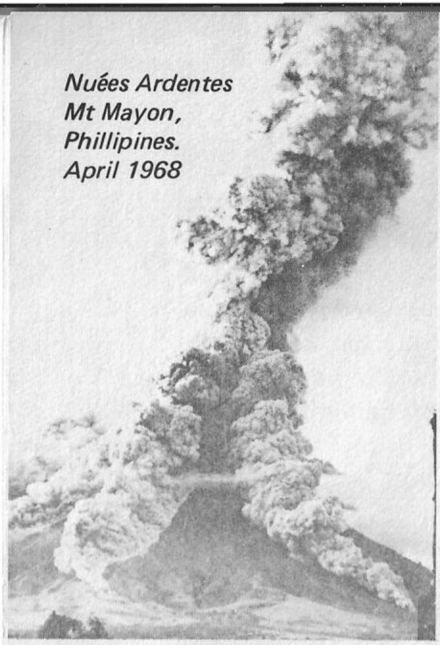
About 20,000 years ago, whilst a new cone was being constructed at the Egmont centre, *magma* (molten rock under a volcano) also burst to the surface to form Pukeiti cone. The lava flows extruded at this time include that at Dawson Falls and the remnants at Warwicks and Humphries Castles. Fanthams Peak is also known to have existed at this time because it deflected later lahars to the south-west and has protected a strip of older ringplain between Auroa and Mangawhero Roads near Awatuna. From 16,000 years ago the remainder of the present upper cone was built accompanied by frequent collapses of unstable materials to the west and eruption of volcanic ashes that now form the topsoil over much of Taranaki (the Oakura and Okato tephras and the Stratford Shower). At least two lahars have reached the present coastline since then and the younger one, dated at 7,000 years old, was clearly derived from the large "amphitheatre" which now exists between Bobs Ridge and Fanthams Peak.

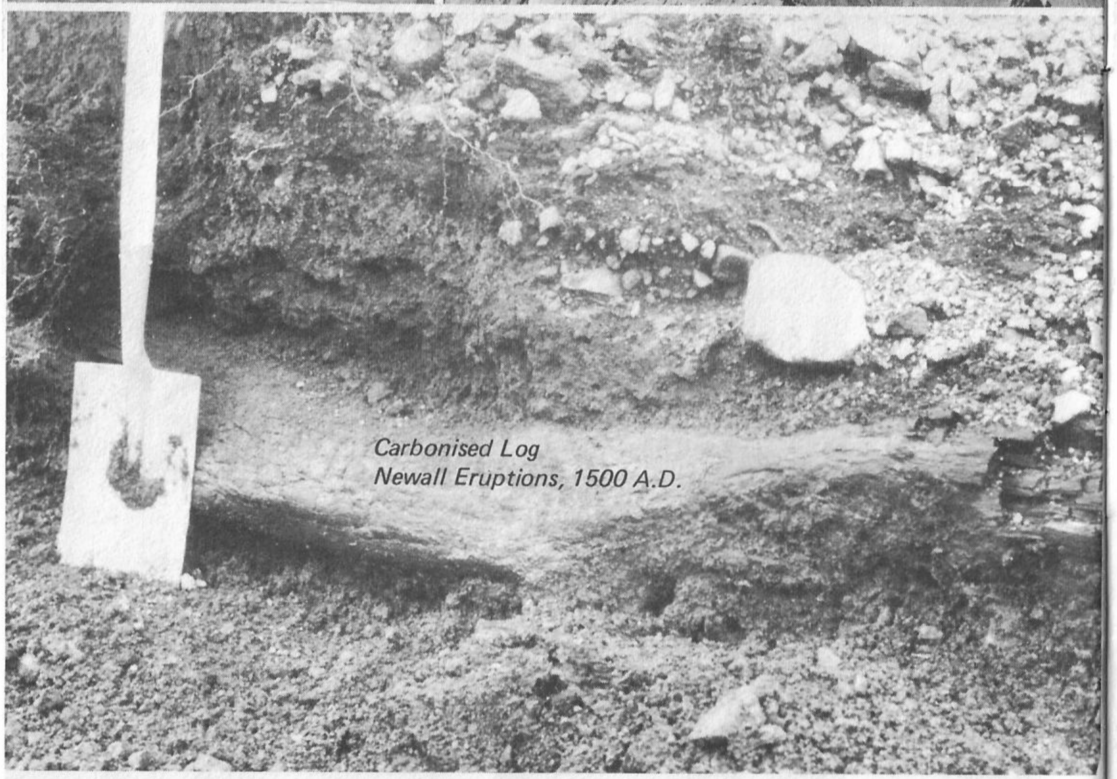
Some of the latest lava flows have descended below the 1,500 m contour and include, with decreasing age, the West Ridge, Dray Track, Sharks Tooth, Skeets Ridge and Minarapa Stream lava flows. The two Beehives, Skinner Hill and The Dome (Ill. p.7) are cumulodomes which probably represent points where magma rose along vertical fractures arranged radially around the base of Egmont at this time (Neall 1971). Some of these fractures are clearly visible as linear stream channels in aerial photographs of Kaupokonui, Mangawhero and Mangawheroiti Streams.

Over the last 500 years a multitude of events has occurred on Egmont which tend to obscure the earlier geology. About 1500 A.D. hot incandescent gas-charged clouds (called *nuées ardentes*) flowed down the Stony River Catchment from Egmont summit, similar to those which occurred at Pompeii although on a smaller scale. Much of the native bush on the north-western slopes was reduced to carbonised logs and fires





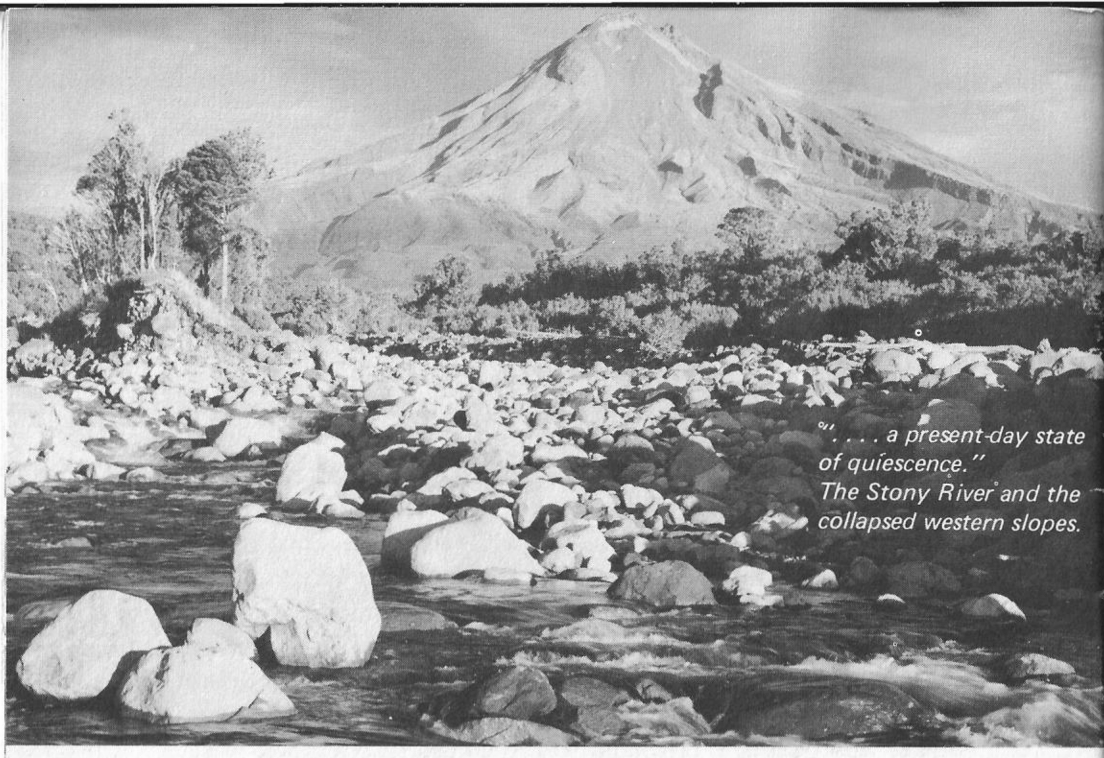

Nuées Ardentes
Mt Mayon,
Phillipines.
April 1968


Carbonised Log
Newall Eruptions, 1500 A.D.

also swept 3 km northwards across the western slopes of the Pouakai Range (Druce 1970, p.53). This was followed 150 years later by the eruption of the Burrell Lapilli which was an air-fall pumice (Topping 1972). Maori ovens (umu) have been found beneath both these eruptives. About 450 years ago the present summit of Mount Egmont, a *tholoid* (volcanic dome within a crater) was also emplaced. The last eruption on Egmont occurred about 1750 A.D.

In the intervals between the latest short-lived eruptions, Egmont has also suffered severe erosion probably due to heavy rainstorms. The loosely jointed lava flows, some resting on loose gravel, are relatively unstable and at least 11 debris flows have originated over the last 400 years from minor lava flow collapses. The western crater rim was the source for a number of these flows. Following the 1500 A.D. eruptions, debris washed down Stony River in a large flood covering 15 km^2 of what is now valuable farmland in the Okato district. The latest debris flow occurred about 100 years ago and reduced the native bush to ground level from Pyramid Stream to the Park boundary.

Indeed, Egmont is no extinct volcano but merely an active one in a present-day state of quiescence.



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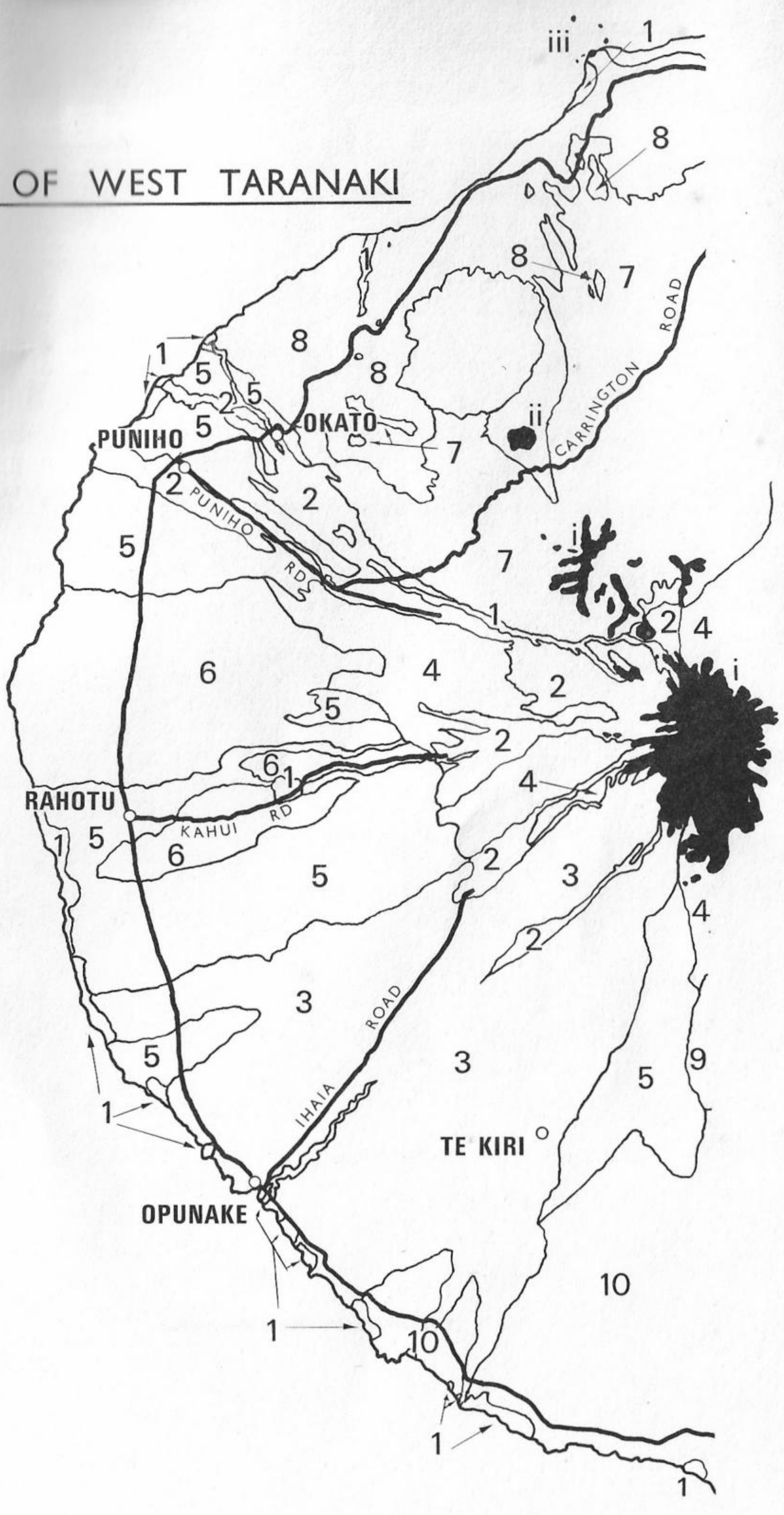
LAHARS OF WEST TARANAKI



REFERENCE

- i Lava flows of Pouakai and Egmont.
- ii Pukeiti, a lava cove.
- iii Paritutu and Sugarloaf lavas.

1 Recent river gravels, swamps, sand dunes and older, marine benches.

2 Gravels deposited by landslides and floods during the 500 years since the Newall eruptions.

3 A 7,000 year old lahar from the amphitheatre between Bobs Bluff and Fanthams Peak.

4 Lahars dated between 500/12,000 years old.

5 A lahar of 14,000 years ago.

6 Lahars of 25,000 years ago with many surface mounds.

7 Pouakai Range surfaces eroded about 20,000 years ago during the last Glaciation.

8 Older surfaces of the Pouakai volcano.

9 Remains of the Kaitake volcano.

10 Gravels and sandstones of southern Taranaki, about 25,000 years old.