

Volcanic Hazard in Auckland

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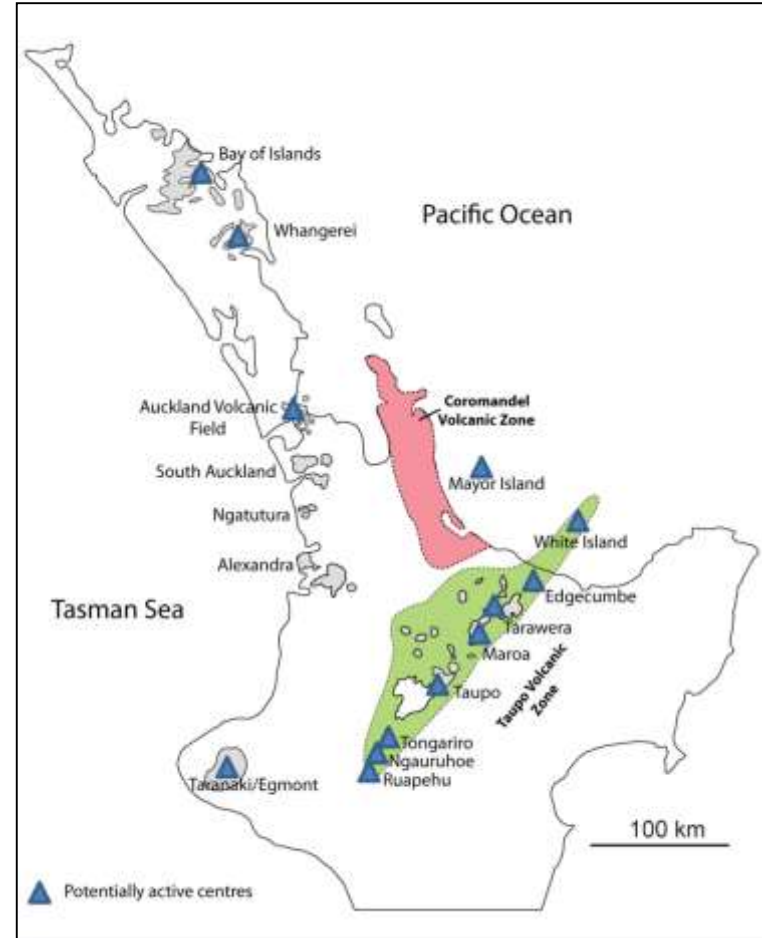
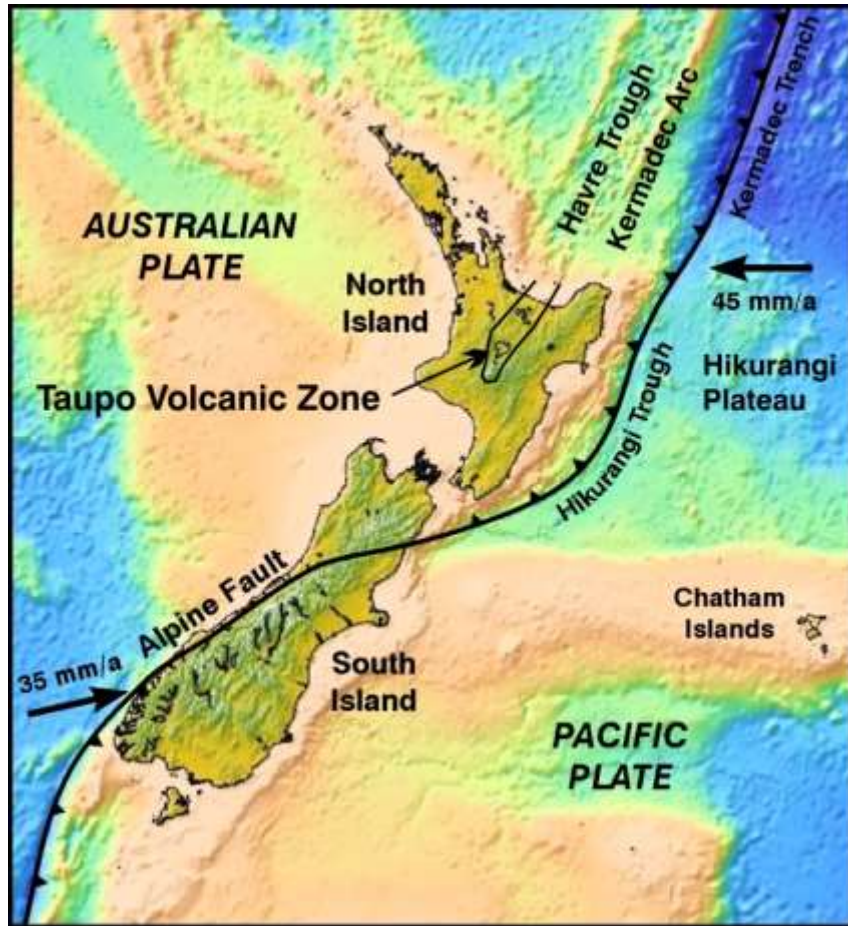
TVNZ artist's rendition of the start of an Auckland eruption, 2012



Kilauea, 3 weeks ago

Auckland lies some distance from the plate boundary

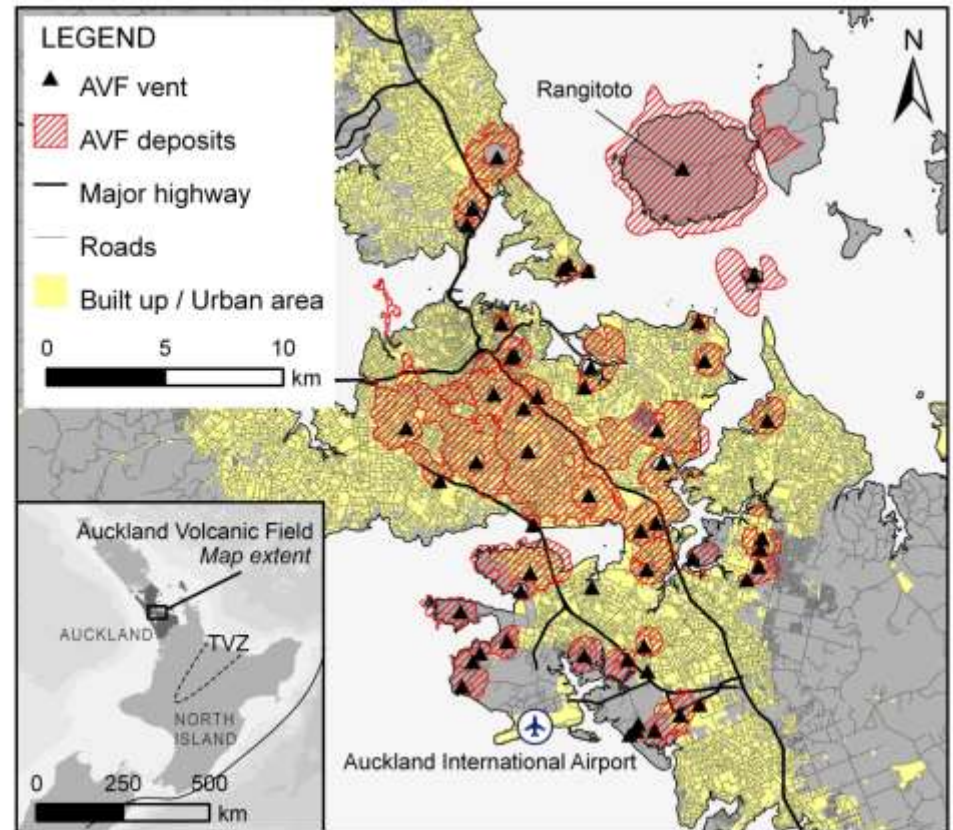
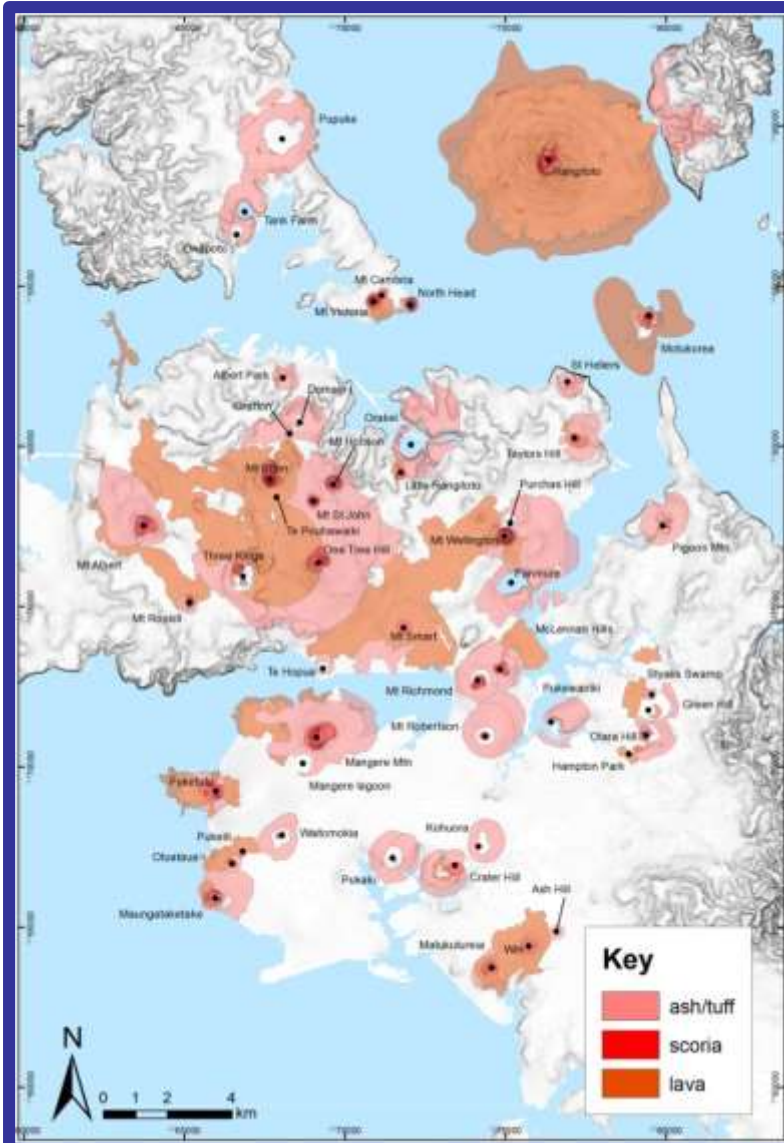
*It hosts an intraplate volcanic field
..... and receives ash from distal volcanoes*



Assessing hazard in Auckland must consider a local **Auckland Volcanic Field** eruption, as well as ash fall from a **distal volcano**

Auckland Volcanic Field

- ~53 small “monogenetic” basaltic centres
- Intraplate (not related to subduction)
- Active from ca. 200,000 to 550 yBP
- Lies beneath Auckland, pop. ~1.5 million



from Lindsay et al. 2016

Types of volcanoes

Maars or explosion craters (e.g. Lake Pupuke, Orakei basin, Onepoto Domain)



*Ukinrek maars, 1977.
Photo C. Nye ADGGS*



R. Russell ADFG

Scoria/cinder cones (e.g. Mt. Eden, Mt. Wellington, Mt. Albert)



*Heimaey and Surtsey,
Iceland, 1973 and 1963*



*Tuff cone,
North Head*



AVF hazards

- **Edifice formation** (explosion crater, scoria cone, fissure)
- **Base surges** (fast moving clouds of ash, gases and debris)
- **Tephra fall** (fine ash as well as larger particles)
- **Ballistics** (large pieces of lava thrown out of the vent)
- **Lava flows** (magma erupting effusively; ocean entry)
- **Gases** (mostly H₂O, CO₂ and SO₂)



Ukinrek, Alaska C. Nye ADGGS



R. Russell ADFG



Heimaey, Iceland

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Kilauea is a great analogue for Auckland, in terms of lava, ballistics, tephra and gases



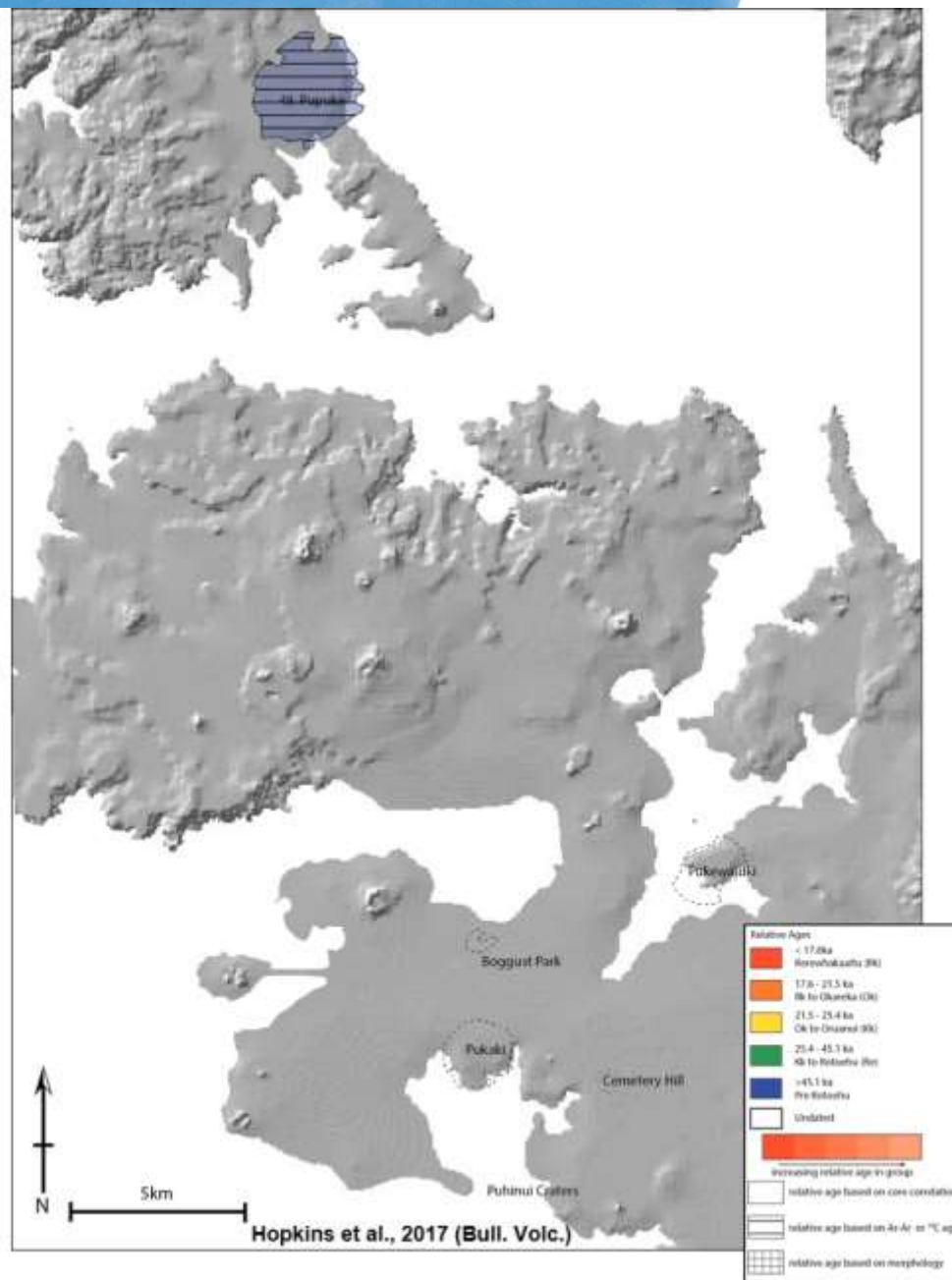
Duration of a future eruption

Analogue eruptions typically last from a few weeks to a decade

Paricutin, Mexico 9 years (1943 -52)

Heimaey Iceland: 7 months (1973)





Relative Order	Centre Name	Mean age (ka)	Error (1sd)
48	Popuke	193.2	± 2.6
47	Onepoto	187.6	-
46	Tank Farm	181.0	± 1.0
45	St Heliers	161.0	± 18.0
44	Albert Park	145.0	± 2.0
43	Orakei	126.0	± 3.0
42	Mt Albert	117.6	± 5.2
41	Grafton	106.5	-
40	Domain	106.0	± 4.0
39	Mt Roskill	105.3	± 3.1
38	Maungetakake	88.9	± 2.4
37	North Head	87.5	± 7.6
36	Mt St John	75.3	± 1.7
35	One Tree Hill	67.0	± 6.0
34	Mangere Lagoon	59.5	-
33	Mangere Mt	59.0	± 10.0
32	Hampton Park	57.0	± 16.0
31	Otara	56.5	-
30	McLaughlins Hill	48.20	± 3.2
29	Mt Cambria	42.30	± 11.1
28	McLennan Hills	41.30	± 1.2
27	Mt Victoria	34.78	± 2.0
26	Mt Hobson	34.20	± 0.86
25	Kohuora	33.71	± 1.16
24	Three Kings	31.04	± 0.9
23	Hopua	31.00	-
22	Crater Hill	30.40	± 0.4
21	Ash Hill	30.70	-
20	Wiri Mt	30.20	± 4.6
19	Mt Richmond	30.20	± 2.08
18	Taylor's Hill	30.20	± 0.12
17	Puketutu	29.80	± 2.2
16	Te Pou Hawaiki	28.53	-
15	Mt Eden	28.03	± 0.26
14	Panmure Basin	25.23	± 0.86
13	Little Rangitoto	24.55	± 0.29
12	Motukorea	24.41	± 0.29
11	Pigeon Mt	23.35	± 0.35
10	Mt Robertson	24.26	± 0.4
9	Otuataua	24.20	± 0.88
8	Waitomokia	20.30	± 0.14
7	Mt Smart	20.08	± 0.1
6	Green Mt	19.60	± 3.3
5	Styaks Swamp	19.10	-
4	Pukeiti	15.31	± 0.65
3	Purchas Hill	10.90	± 0.14
2	Mt Wellington	10.00	± 0.5
1	Rangitoto 1	0.55	± 0.07
0	Rangitoto 2	0.50	± 0.05

Likelihood of a future eruption in AVF?

Approach A:

55 eruptions over 200,000 years.

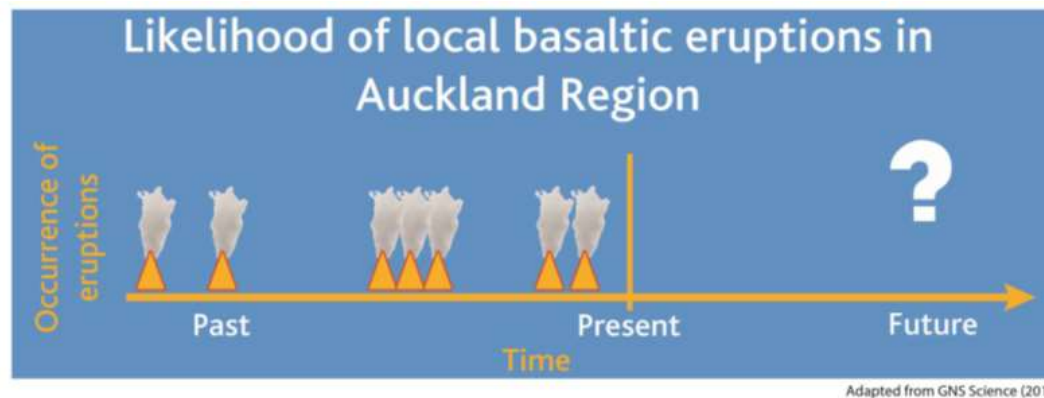
Recurrence rate = 1 eruption every 3,600 years.

Approach B:

Increased eruption rate since 60,000 years. Using this time period:

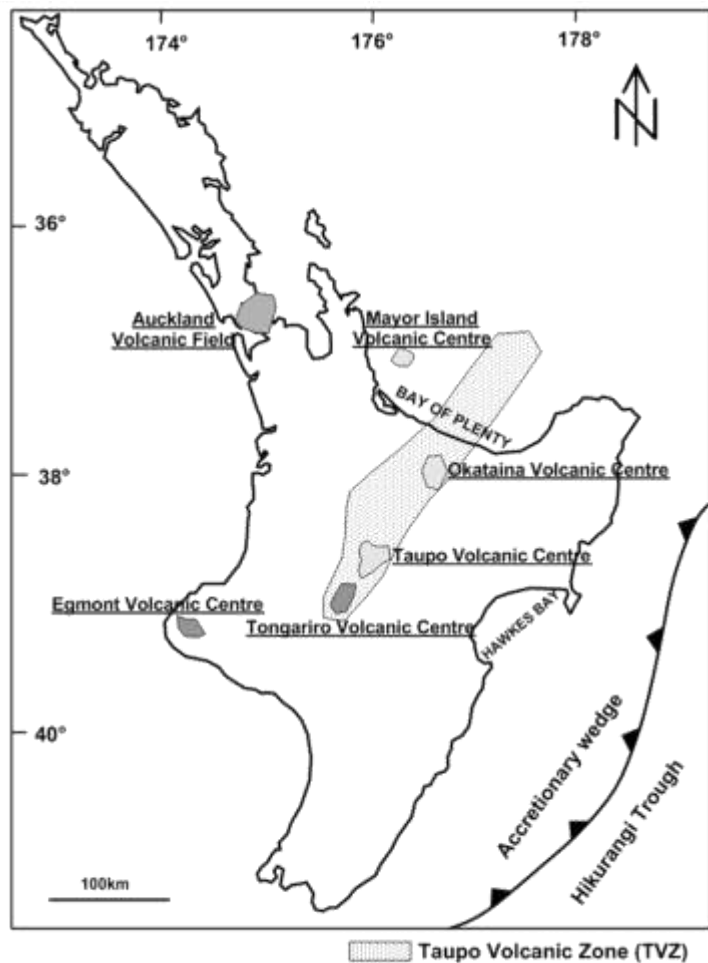
Recurrence rate = 1 eruption every 1,500 to 2,600 years.

(But within that time, repose periods have ranged from 50 to 10,000 years.....)



So..... No one number is adequate to fully explain hazard, but an eruption is unlikely in our lifetime

Distal ash



DEVORA

Photo by Shane Cronin



Travel plans go up in cloud of ash

By Nicky Smith

THE volcanic eruption in New Zealand's North Island has caused a major disruption to air travel, with many flights cancelled and others delayed. The eruption, which began on Monday, has produced a massive plume of ash and smoke that is visible from space. The New Zealand Civil Defence Corporation has issued a warning that the ash plume could pose a risk to health and the environment. Travelers are advised to check the status of their flights and to avoid breathing in the ash.


Frequency of tephra fall

**Estimated minimum frequency of tephra fall
from local and distal volcanoes in Auckland
over the last 11,000 years**

Volcanic Source	Minimum frequency
Okataina Volcanic Centre	Once every 3,000 years
Taupo Volcanic Centre	Once every 1,300 years
Mayor Island	Once every 9,000 years
Taranaki Volcanic Centre	Once every 3,000 years
Tongariro Volcanic Centre	Once every 2,200 years
Auckland Volcanic Field	Once every 3,000 years
Total – all sources combined	Once every 400 years



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Welcome

Determining Volcanic Risk in Auckland

Auckland is a vital link in New Zealand's economy, and the city and surrounding region are internationally desirable places to live and work. However, Auckland sits on a volcanic field.

The DEVORA research programme is aimed at a much-improved assessment of volcanic hazard and risk in the Auckland metropolitan area, and will provide a strategy and rationale for appropriate risk mitigation.

[Details](#)



<http://www.devora.org.nz/>
<https://www.facebook.com/DEVORAProject/>

Or join the DEVORA mailing list. Email: j.lindsay@auckland.ac.nz

CITY OF VOLCANOES

THE AUCKLAND VOLCANIC FIELD NGĀ TAPUWAE Ō MATAAHO


An introduction to Auckland's volcanoes

Pupuke
Auckland's Oldest Volcano

Lake Pupuke is up to 200,000 years old. The lake was formed in a volcanic explosion crater that filled with water over time. Such explosion craters, called *maars*, form when hot rising magma comes into contact with water, causing the water to quickly heat into steam and create an explosion that breaks and ejects the surrounding rock to form a crater.

53 VOLCANOES

There are approximately 53 volcanoes in Auckland. Although it is unlikely that it will happen in our lifetime, evidence of a hot magma source deep beneath Auckland suggests there could potentially be an eruption in the future.



Volcanic deposits
Over the centuries, these volcanoes have deposited layers of volcanic ash and lava. Many of these deposits are buried by the city or buried so deep into the ground that they are not visible and are only known to be there from the ground level below the surface.

Maungakiekie
ONE TREE HILL

Maungakiekie is an example of a *scoria cone*. The cone is made up of scoria (small, dark, iron-rich, fragmented volcanic rock with vesicles or holes). The vesicles were once filled with volcanic gases, and indicate that the eruption was moderately explosive.

Rangitoto
Auckland's Youngest Volcano

Rangitoto's full name is Ngā Rangī-kōhanga a Tānekehuia, after a Māori captain who was awarded there. It experienced at least two eruptions about 800 years ago. Lava flows make up the volcano's broad slopes, and a *scoria cone* made of loose rock forms the cone shape at the top. Lava tubes can be found throughout Rangitoto. These tunnels were formed when the outer surface of the lava cooled and hardened before the inside, which continued to flow.

260 METRES (853 FEET)

Auckland's youngest volcano is also its **LARGEST**. Rangitoto is 10 times larger in volume than any other AVF volcano, and is taller than the viewing deck in the Auckland Skytower.

Did you know?
Many of the volcanoes in Auckland were formed in the same way as the famous volcano in Hawaii. In 2014, 14 of the volcanoes were identified as being in a 'Dormant' state and are not expected to be active again.

220 METRES (722 FEET)

The Auckland Volcanic Field is one of the most densely populated volcanic fields in the world.

AVF: from magma to lava

When magma erupts at the surface, it becomes **lava**. Lava flows can be very hot, and can be very dangerous. It can flow down the sides of a volcano, or it can be ejected into the air, where it can fall back to the ground, creating a *pyroclastic flow*.

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