

Supplementary File 1

Summary of oral accounts regarding the 1888 Ritter Island tsunami (from 2004; based on David, 2007)

These accounts summarise recollections extant in communities around the Dampier Strait in 2004. They were shared with Manuel Coss David, Hugh Davies and Harrison Gedikile during fieldwork in the region, principally by elderly villagers on western New Britain, Sakar, Umboi and Tolokiwa, who were either second or third generation after the event. This summary is based on that documented within: *David, M.C., 2007, The 1888 Ritter Island collapse tsunami: new data from sediments and oral histories. BSc. (Geology) Thesis, School of Natural and Physical Sciences and UPNG Centre for Disaster Reduction, University of Papua New Guinea, 174 pp.*

The records in David (2007) only provide information that was deemed to relate to the 1888 tsunami. Several other communities were visited but no accounts recalling the 1888 tsunami were identified. This may be because the communities were settlers from inland areas or elsewhere after the event, or that recollections of the tsunami had not survived across the generations since 1888.

West coast of New Britain

Kilenge village: Several elderly men were interviewed. Their account stated that the tsunami came in the afternoon at about sunset, roughly a few minutes after some sort of explosion was seen on Ritter Island but no major earthquake was felt. At about the same time, a big traditional “singsing” (celebration) was taking place in a big village NE of Kilenge called Akoni. Some minutes after the explosion on Ritter, they saw the sea drying up beyond the normal low tide zone. After a while, three large waves approached the coast with unusual lights or fire-like glows on their crests, some comparing them to an ancient Roman soldier’s white to reddish brown headdress.

The first wave was small, but the second and the third were much bigger, causing much of the destruction along the coastline, including the complete devastation of Akoni village and up-rooting trees and palms. The height of the waves was estimated at average tree-top height; probably more than 15 m, with inundation extending even further inland. These waves carried marine organisms and coral boulders from the sea, and uprooted trees that were dumped further onshore. The backwash of the water carried corpses of traditionally dressed people of the Akoni, lighter materials and debris that were swept back into the sea, where some floated while others sank. Kilenge village encountered less damage than Akoni.

Tauali village: One elderly man provided some details of the tsunami, reporting that his ancestors observed the approaching tsunami at about sunset. Some sort of an explosion or fire was seen on Ritter Island. Soon after, the sea receded beyond the normal low tide zone and built up at a distance. No corresponding earthquakes were felt or any unusual noises heard. This unusual retreat of the sea made the people run inland for safety. As a result, no one was killed by the tsunami. The waves approached straight from Ritter with a fire-like glow (that appeared to be like a Roman soldier’s reddish brown headdress) and, as they reached the coast, were as high as the tree tops. The height was estimated from the small, 53 m bluff “Mt Mongo” (just adjacent to Tauali), where the waves hit and splashed over the top. The tops of the waves could have been around 15-20 m. They caused widespread devastation, destroying houses and up-rooting trees. Coral boulders ripped up by the tsunami were deposited just offshore in the intertidal zone.

Witnari village: One elderly man provided details of two huge tsunami waves that came from the direction of Ritter Island and destroyed the coastline. No one at Witnari was killed or injured because their village was a few hundred metres inland. He mentioned two white men (as Kapi Taya & Kapi Molo) who were at Lagoon Point and were shooting at Ritter Island with their guns, when the tsunami came and washed them away.

Walawalapua village: One elderly woman recalled information about the event which she had heard from her parents who were teenagers at the time. There were small aftershocks (*?earthquakes or volcanic activity*) but no mainshock was felt before the tsunami arrived. The tsunami approached from the direction of Ritter in the early hours of the morning (~4-6 am) because her parents and other villagers were asleep when the small aftershocks woke them up. The villagers observed three huge waves estimated to average tree-top height (15-20 m) come rushing towards their village; the first two were bigger than the third, which had smaller associated waves. They did a lot of damage by up-rooting trees some 20 meters inland and also dumped lots of marine organisms at the beachfront. No one in the village was hurt or killed because of its location some hundreds of meters away from the coast.

Aisega village: One elderly man related details that were passed on to him by his ancestors. Before the tsunami came, the sea receded beyond the normal tidal zone, revealing fish and shells in the exposed fringing reefs, tempting some of the villagers to collect them but, because of abnormal receding of the sea, the Aisega villagers instead ran inland to higher ground for safety.

The tsunami hit around midday (12-2 pm) from a northerly direction (from Ritter Island) and was accompanied by a strange/unusual noise as it approached the coastline. There were two huge waves, referred to as Kalvo and Manuga, and in these waves were two white men (Kapi Tai and Kapi Molo) who rode in them. Inundation was estimated to reach about 500 m inland where the wave ran up some of the streams and completely destroyed the greater part of the coastlines. The tsunami height could have been quite high, around 15 metres. There were no fatalities at Aisega because the village was further inland on higher ground, where the impact of the tsunami could not reach.

Two white men, referred to as Anut and Pango, came sailing into Lagoon Point and settled there. The locals started to exchange vegetables with these men for knives, salt, axes, etc. The Ritter tsunami killed one of the white men somewhere between Witnari and Ura villages and the other was killed just past Ura village at a river called Manim. A few days after the tsunami, an outbreak of strange blistering sores that looked like boils inflicted the villagers, nearly wiping out a settlement called Taturr-pua.

Before the 1888 Ritter collapse tsunami there were at least 3 days of darkness, probably caused by fine volcanic ash blanketing the sky over New Britain as a result of a volcanic eruption (possibly Langila). However, exact dates are not known (*the implication is that this refers to an earlier, unrelated event*).

Aumo village: One elderly woman recalled some details conveyed to her by her parents when she was a little girl. The tsunami came from the northerly direction of Ritter Island. The Ritter tsunami had two huge waves that were referred to as Kapi Tai (small wave came first) and Kapi Moli (large wave came second). And these two waves dumped marine flora and fauna (fish, shells, etc.) along the coast and landward. The timing of the tsunami occurrence was unknown because Aumo village at that time was further inland (more than 5 km). She made mention of two men with a pinkish headdress that rode in these two waves.

Sakar

Alairo village: Most of the young people had some knowledge of the Ritter tsunami from their ancestors and also details of minor post-tsunami eruptions of Ritter Island that happened in the 1970s and 80s.

Before the tsunami arrived, there were earthquakes felt and rumbling noises heard for some time. When the main shock occurred, during the early hours of the morning (~4-6 am), everything shuddered, including trees/palms and houses. Also associated with the main shock were unusual phenomena like water squirting out of the ground, the smell of fire and a continuous popping sound, similar to that of burning bamboo or gunshots.

A short time after the main shock, they saw Ritter Island explode and, subsequently, the western half of the island collapse and sink into the sea. A few minutes after the collapse, two huge (tsunamic) waves (not much distance apart), built up at a distance and came charging towards Sakar, reaching about tree/coconut palm top height (more than 20 m high) as they approached the coast. As the tsunami came towards Sakar, there were unusual fire-like glows observed on the waves with an accompanying noise similar to that of a low flying helicopter. The rollers brought coral, shells and marine organisms from the ocean and deposited them on land. The intensive damage caused by the tsunami, estimated to extend about 500 m inland, included uprooting of trees/palms and complete destruction of houses. Inundation must have gone further inland.

Two white men (Kapi Tai – seaman & Kapi Molo – long man) rode in the waves. An epidemic of small pox or sores were inflicted on the tsunami survivors a few days after the event, associated with the tsunami.

Tolokiwa

Mulau village: One elderly man recalled a few details of the Ritter tsunami passed on from his ancestors. The tsunami arrived in the morning (~6-8 am) after a few small earth tremors were felt. There were three waves, the first wave being small, just passing underneath the houses built on posts (<1.5 m), and this made the villagers move inland to higher ground. The second wave was larger and third wave of sufficient size to destroy a large extent of the Tolokiwa coastline facing Ritter Island, including the houses. Fortunately, no one was killed.

Bun village: One elderly man mentioned at least four tidal wave events that had been experienced at different times along the coast of Bun village. The first one was the Ritter tsunami that came at just about the morning hour with a maximum wave height of approximately 5 metres, without the initial signs of a receding sea or associated earthquakes. No one was killed or injured, but one, huge wave came and swept everything including pigs and dogs back into the sea with the backwash.

The second and third events (*implied to be later than 1888*) caused slight damage but not to the degree of the Ritter tsunami. The fourth event occurred recently, somewhere around 1997, with no major damage.

Umboi

Masele village: Villagers mentioned the tsunami but could not recount any details, since they settled here from inland villages and from Tolokiwa after the tsunami.

Kabi village: An elderly man recalled details of a lady going down to the beach early in the morning (~4-6 am) when she saw smoke and fire coming out of Ritter. She returned to the village and told

everyone to move inland because of strange happenings on Ritter, as a result of which not many people lost their lives. However, a few days after the tsunami, the villagers were inflicted by sores and boils believed to be brought on by some sort of dust or other agent. A large village called Salegong, with an estimated total population of more than 2000, located somewhere between Aupwell and Kabi, was completely destroyed by the tsunami and almost everybody perished.

Kampalap village: An elderly man provided brief details, mentioning that his ancestors felt some earthquake/tremors and saw water (smoke?) spouting from the vent of Ritter Island volcano accompanied by some explosions. After a moment or two, huge tsunami waves came, swept away everything on the coast, and dumped corals, shells and other marine organisms that they brought with them. At some points along the coast, the tsunami scoured and changed land profiles and the shoreline. This event happened in the evening because, at that time, a large village just north of Kabi, formerly known as Salegong, was having a traditional singsing, which is usually held in the evening until late, when the tsunami hit them. No description of the wave(s) was available because Kampalap village at that time was a few hundreds of meters inland from the coast. No one was injured or killed at that time.

Marille village: A man gave a brief account of two events. The first was a long period of darkness, estimated to have lasted 40 days and nights. After the darkness, there was very fine dust everywhere, on the trees, leaves and ground (most likely volcanic ash caused by the eruption of Long Island). The second report was of a subsequent tsunami (most probably the Ritter tsunami) that arrived sometime in the morning. The waves caused considerable damage along the Marille coastline and the tsunami run-ups dumped ripped-up coral boulders, fish, shells and other debris on the coast.

No one was killed or injured in this tsunami because, prior to the incident, everyone in the village was informed of the approaching danger by their ancestral spirit, a fortune-teller, and the villagers moved to high ground for safety.

Aromot Island: A group of elderly men gave a brief account of the Ritter Tsunami. About early in the morning, the villagers were preparing to go out fishing, gardening and trading on Umboi Island when two huge waves approached from an easterly direction with some associated smaller waves.

There were no warning signs of an approaching tsunami, such as the sea receding, earthquakes and any other unusual phenomena. Aromot Island was almost completely obliterated; the land area decreased in size, with only two small, twiggy trees left standing. Today, these two trees have fully grown, as the men pointed out during the interview.

A pregnant woman perished in the tsunami, but everyone else on the island escaped to Umboi Island by dug out wooden canoes except for a father (Sarago) and his son (Ante). They both clung on to a log brought in by the first wave and were swept to Umboi. They later reunited with the other villagers and told them of their experience. This story has been retold through generations until the present.

Mandok Island: One elderly man gave a brief account of two tsunami events. The first tsunami (presumed to be the 1888 Ritter event) came around midday after an earthquake (main shock) that had waves reaching the height of the stilt post of traditionally built houses (~1-2 m high). Everyone on the island gathered on elevated ground as the associated smaller waves came over the island. Only a small girl perished in this tsunami because her mother, clutching another younger child, could not securely hold her. This tsunami is believed to have been caused by eruption of a volcanic mountain on Umboi, and debris dumped into the ocean created Ritter Island. Today, the remnant of the presumed erupted mount is referred to as Lake Silli (on Umboi, opposite Ritter).

The second event occurred around the 1950s. This tsunami lasted for about two days and no one was killed or injured, since a Catholic priest informed the villagers to move to safe, high ground, probably because he noticed the initial signs of approaching danger.

Supplementary File 2

Site details and additional descriptions for potential tsunami deposits not detailed in Figures 3 and 4

Table SF2: Field site locations (note that coordinates are approximations based on original field maps)

Island	Locality	Latitude	Longitude	Site details	Log details	Grain size analysis distance from shore
New Britain	Molomate	-5.4537	148.4500	Undulating sandy berms extending from the coastline with shrubby vegetation	Below	At 207 m
New Britain	Kilenge	-5.4704	148.3627	Coastal plain	Fig. 4	At 195 m
New Britain	Sagsag	-5.5869	148.3275	Flat plain with shrubby vegetation.	Fig. 4 (site 1; site 2 below)	At 144 m
New Britain	Dorf Point	-5.4814	148.3519	Coastal plain	Below	NA
New Britain	Sumel	-5.4970	148.3440	Coastal plain	Below	NA
New Britain	Galegale	-5.4537	148.3986	Wide alluvial plain extending 1-2 km inland with shrubby vegetation	Below	NA
New Britain	Cape Gloucester	-5.4446	148.4111	Coastal plain	Below	NA
New Britain	Witnari	-5.5890	148.3560	Coastal forest	Below	NA
Umboi	Masele	-5.4745	147.7689	Coastal plain	Below	97 m
Umboi	Maipurr	-5.4596	147.7830	Coastal plain	Fig. 3	3 units at 134 m, and one at 234 m
Umboi	Barang	-5.5346	147.9351	Coastal cliff	Fig. 3	Shoreline exposure
Umboi	Kampalap	-5.5827	148.0406	Coastal cliff	Fig. 3	3 units at shore, and one at 29.2 m
Umboi	Kabi	-5.5504	147.9935	River-cut face	Below	NA
Tolokiwa	Auwar	-5.3306	147.6125	Coastal cliff	Fig. 4	NA
Sakar	Alairo	-5.4176	148.0653	Gentle slopes	Fig. 3	250 m and 400 m
Sakar	Yaba	-5.4393	148.0950	Coastal berm transitioning to steeper slope	Below	NA
Sakar	Yok Point	-5.4084	148.1124	Beach exposure and cliff	Below	NA

Additional site descriptions:

New Britain

Galegale: 84 m from high water mark and ~1 m elevation. 0-72 cm, brown coarse silt to fine sand with a 5-cm humus topsoil, no lamination. 72-106 cm, black, coarse to fine sand and minor white (pumice?) pebbles disseminated, no relics of coral or shelly fragments. >106 cm, waterlogged sand.

Molomate: Hole at 207 m from the high water mark, ~3 m above sea level. 0-110 cm, black fine to medium sand with greyish white silt disseminated near the surface (0-10 cm). 110-120 cm, black and white, medium to coarse sand with inclusions of unrecognizable carbonate grains (possibly fine coral and shelly fragments) and disseminated with some granules. No grading or lamination (presumed marine deposited sediments). >120 cm, unable to dig further.

Cape Gloucester: Similar elevation to Molomate, on the same alluvial plain, 84.5 m from high water mark. 0-45 cm, black coarse to fine sand, fine sand and humus in top 5 cm. 45-80 cm, black, transiting to dark brown, medium sand grading downward to very coarse sand and few smooth, subrounded/rounded pebbles and black cobbles. >80 cm, black, medium to coarse sand with few rounded pebbles.

Kilenge: In addition to the log shown on Fig. 4; At 88 m from the shore, 15 cm topsoil, silt to fine sand, then 15-35 cm greyish brown fine sand to coarse sand, pebbles at 35 cm. 35-90 cm, black silt to coarse sand with leafy/woody material. 90-100 cm, black peated silt to very fine black sand with few pebbles. 100-115 cm, black to greyish brown silt and sand with few pebbles. >115 cm waterlogged. Then at 131.5 m from shore, 0-20 cm medium/fine to coarse sand, with humus in top 5 cm. 20-105 cm, gradational black to dark brown medium sand grading downward to very coarse sand and few smooth, subrounded pebbles and black cobbles. >105 cm, black fine sand to coarse silt. At 281 m from shore, 20 cm of black silty soil and humus, then 20-30 cm, brown very fine to coarse sand with minor small pebbles, 30-50 cm black loamy silt with few pebbles at 50 cm, then 50-120 cm, angular to subrounded pebbles and minor cobbles set in unconsolidated black to brown silt-sand matrix. At 363 m from shore, 23 cm of topsoil with brown silt and humus, 23-56 cm brown fine to coarse sand disseminated with pebbles and minor smooth rounded pumice granules and pebbles at 56 cm, fining upwards. 56-72 cm greyish brown fine silt to fine sand, laminated. 72-120 cm greyish black silty loam. >120 cm brownish greyish fine silt (tephra?).

Dorf Point: 68 m from high water mark, close to sea level. 0-20 cm top soil with plant material and humus. 20-90 cm greyish white to white fine to coarse sand, fragmented, with unidentifiable coral and shells with few pebble size coral/shell fragments and disseminated black fine to coarse sand (30% black sand and 70% fine coral and shell fragments). >90 cm waterlogged.

Sumel: 66 m from high water mark, 2 m above sea level. 0-30 cm black silt to fine sand. 30-40 cm black silt to sand with minor coral fragments. 40-120 cm, black-brown silt/mud grading down to sand layer, with no coral fragments. At 120 m, 4 m above sea level, 0-20 cm black soil, then to 80 cm black fine silt (volcanic ash?). 80-120 cm black grading to brown fine silt at base.

Sagsag 2: A second exposure on a wave cut cliff at the high water mark. 0-70 cm black fine to coarse sand with plant material. 70-100 cm dark brown silt to coarse sand with disseminated minor granulae and pebbles and plant roots. 100-115 cm grey to greyish brown fine silt to clayey mud, possibly very fine volcanic ash. 115-155 cm dark brown to black peated silt and mud with woody and leafy material, no relics of coral or shelly fragments and no other sedimentary features. >155 cm greyish black fine to coarse sand, waterlogged. Inland, at 24 m from shore, 40 cm of topsoil followed by black-grey silt to sand with coarse sand patches to 115 cm. At 225 m from shore, 45 cm of topsoil with a brownish black fine sand from 45-100 cm, then 100-120 cm greyish-black to brown silt to fine sand.

Witnari: A log buried 1 m below the land surface and 200 m from the coast, reported by local man to have been up-rooted and deposited by the Ritter tsunami.

Umboi

Masele: 97 m from high water mark, close to sea level. 0-50 cm brown loamy silt and humus. 50-57 cm brown fine silt combined with white, very fine unidentifiable carbonate sand fragments (coral/shelly material). >57 cm brown fine silt.

Kabi: River cut face 200 m from shore, 1.5-2 m in height. 0-100 cm, top 10 cm comprised of top soil, silty sand and humus, then brown fine to coarse sand with rounded granules, pebbles and cobbles, no carbonate fragments encountered. No grading; poorly sorted and matrix supported but unconsolidated. 100-130 cm, brown silt to medium sand layer with other grain sizes. >130 cm, well rounded granules, pebbles cobbles and boulders with brown fine to coarse sand. No grading, poorly sorted and clast supported but unconsolidated. No carbonate remnants.

Sakar

Yaba: 100 m from shore, on coastal berm. 0-75 cm top soil, brown silt to fine sand. 75-100 cm waterlogged greyish black to black peated silt to medium sand, with sand to pebble sized coral and shell fragments. >100 cm waterlogged. At 200 m inland, on steeper slope, 0-120 cm of topsoil, brown to greyish brown soil, with a mid-section of greyish black silt to fine sand, brown coarse silt to sand at the base with minor occurrences of pebbles and granules.

Yok Point: Coastal exposure, 0-40 cm of black peated silty clay with woody and leafy material. 40-60 cm water saturated black silt to medium sand with sand to pebble sized coral and shell fragments. > 60 cm waterlogged.

Zaim: An additional site north of Alairo. Difficult to dig due to extensive cobbles, but locals reported that the tsunami swept over this area and completely destroyed a village in its path.

Supplementary File 3

Coral boulder dimensions measured from coastal environment. Note that many more boulders were observed in the intertidal zone but not measured

Island	Locality	Latitude (S)	Longitude (E)	Height (m)	Width (m)	Distance	Elevation (m)	Volume (m ³)
						from high water mark (m)		(assume ellipsoid, horizontal)
New Britain	Kilenge	-5.47047	148.36266	1.2	2.1	67	0.7-1.8	2.8
New Britain	Kilenge	-5.47047	148.36266	0.7	3.3	32	0.7-1.8	4.0
New Britain	Kilenge	-5.47047	148.36266	1.1	2	66	0.7-1.8	2.3
New Britain	Dorf Point	-5.48142	148.35192	3.5	5.1	75	1.1	47.7
New Britain	Dorf Point	-5.48142	148.35192	1.1	6.5	10	0.84	24.3
New Britain	Dorf Point	-5.48142	148.35192	2.7	3.8	80	1.3	20.4
New Britain	Dorf Point	-5.48142	148.35192	1.7	2.9	84	1.1-1.3	7.5
New Britain	Dorf Point	-5.48142	148.35192	2.4	3.5	84	1.1-1.3	15.4
New Britain	Dorf Point	-5.48142	148.35192	2.1	3	74	1.1-1.3	9.9
New Britain	Sumel	-5.49696	148.34395	1.5	2.2	116	2.7	3.8
New Britain	Sumel	-5.49696	148.34395	1.5	2.4	126	2.7	4.5
New Britain	Lagoon Point	-5.56246	148.31888	1.8	1.8	116	1.3	3.1
New Britain	Lagoon Point	-5.56246	148.31888	1.6	2	270	1.3	3.4
New Britain	Lagoon Point	-5.56246	148.31888	2	3.7	3	1.3	14.3
New Britain	Sagsag	-5.58691	148.3275	1.3	3.7	48	1.3	9.3
New Britain	Sagsag	-5.58691	148.3275	1.3	1.8	51	1.3	2.2
New Britain	Limalye	-5.62077	148.31668	-	3	161	1.1	-
New Britain	Limalye	-5.62077	148.31668	1	2.4	135	1.1	3.0
New Britain	Limalye	-5.62077	148.31668	0.9	2	40	1.1	1.9
New Britain	Limalye	-5.62077	148.31668	2.5	4.1	23	1.1	22.0
New Britain	Ura	-5.63143	148.31488	0.7	2	35	1.5-3.9	1.5
New Britain	Ura	-5.63143	148.31488	1.3	1.4	16	1.5-3.9	1.3
New Britain	Ura	-5.63143	148.31488	3	4.6	17	1.5-3.9	33.2
New Britain	Aisega	-5.73204	148.35356	1	0.8	64	2.1	0.3
New Britain	Aisega	-5.73204	148.35356	0.9	0.5	84	2.5	0.1
New Britain	Aisega	-5.73204	148.35356	0.7	0.7	91	2.5	0.2
New Britain	Grass Point	-5.6577	148.3103	0.5	1.6	76	1.0-3.0	0.7
New Britain	Aumo-Putkuria	-5.76481	148.43209	0.8	0.8	44	1	0.3
New Britain	Aumo-Putkuria	-5.76481	148.43209	1.3	1.1	0	0	0.8
New Britain	Aumo-Putkuria	-5.76481	148.43209	0.3	0.1	111	1	0.0
New Britain	Anep-mete	-5.82596	148.52419	2	1	0	0	1.0
Umboi	Masele	-5.47448	147.76891	0.9	1	9.6	0.3	0.5
Umboi	Masele	-5.47448	147.76891	1.3	0.8	9.6	0.3	0.4
Umboi	Maipurr	-5.45963	147.78303	1.2	0.9	211	>.3	0.5
Umboi	Mos Point	-5.4649	147.843	3.5	8	8	0	117.3
Umboi	Marilli	-5.70585	148.06464	-	0.6	24	3.0-5.0	-
Umboi	Marilli	-5.70585	148.06464	-	0.6	28	3.0-5.0	-