9

LEAD-UP TO INDEPENDENCE

CSIRO on Mount Lamington

Jim Sinclair, a *kia*p who would later become well known as an author and historian of Papua New Guinea, went to the Northern District at the end of 1952 just before Christmas:

Popondetta was not an impressive station ... the crude emergency accommodation hastily constructed [after the 1951 disaster] ... to house the great influx of relief workers still stood. A lot had been achieved, but much remained to be done. (Sinclair 1981, 100)

Compared with the old Higaturu, Popondetta was not nearly as attractive and inspiring a location (e.g. *Pacific Islands Monthly* 1951f), and persuading administration staff to occupy positions at Popondetta must have been inherently problematic. Further, staff of the Department of Agriculture, Stock and Fisheries were reported as having been withdrawn from the Northern District 'once the need for producing food for relief measure had passed ... Interest waned and was reported to be "completely dead" in 1953' (Waddell and Krinks 1968, 16).

There is an impression here of post-disaster, administration fatigue—a vacuum, perhaps created in part by the departure of Murray, but probably more so by the lack of resources needed to make significant, ongoing improvements in the still isolated and recovering district in the early 1950s. Even the volcanologist Tony Taylor had departed after two years of fieldwork in the area. Taylor spent part of the next few years

at the Bureau of Mineral Resources, Geology and Geophysics (BMR) headquarters in Canberra writing his major report on the 1951 eruption, but he maintained a strong commitment to work on other active volcanoes in the Territory. Volcanologist John Best continued running the volcanological observatory in Rabaul in Taylor's absence, and was heavily involved with Taylor and new recruit Max A. Reynolds in assessing several eruptions at other volcanoes during 1953–57, none of which, however, included Lamington. There would be, nevertheless, a considerable amount of further interest paid to Lamington volcano over the next 20 years—up to the time of self-government for Papua and New Guinea in 1973—and, further, to 1975 when Papua New Guinea achieved independence from Australian rule.

An announcement was published in the *Pacific Islands Monthly* of February 1953 advising that a team of government scientists from Australia would be starting a major land resources survey of the Territory, beginning in the Northern Division (*Pacific Islands Monthly* 1953a). The first study area, 'Buna–Kokoda', was the one that included Mount Lamington and its disaster area. The team was from the Land Resources and Regional Survey Section of the Australian Government's Commonwealth Scientific and Industrial Research Organisation (CSIRO), newly named in 1949. An advance team, led by Dr C.S. Christian, had visited the Territory in January 1953 and the field party itself arrived in early July (*Pacific Islands Monthly* 1953b). A request for CSIRO's involvement in survey work for postwar development purposes in the Territory can be traced back to Administrator Colonel J.K. Murray in 1947, as can the decision to start with the Mount Lamington area—Murray prioritised Mount Lamington in May 1951, shortly before his removal as administrator (McAlpine 2017; Keig et al. 2019). The Buna–Kokoda study was the first of 15 land resource surveys conducted by CSIRO in the Territory up to 1973. The Wanigela–Cape Vogel area immediately south-east of Mount Lamington was the second area to be studied.

The survey methodology adopted by CSIRO was innovative. It involved conducting integrated land resource surveys rapidly, and it adopted a multidisciplinary approach aimed at assessing land use potential for agricultural and other developmental purposes by using the skills of a range of scientists—mainly geomorphologists, pedologists, plant ecologists, botanists, foresters and climatologists (Christian 1958; Christian and Stewart 1964; Blake and Paijmans 1973; Keig et al. 2019; Bellamy 2019).

The survey teams used new, cloud-free aerial photography as a basis for the mapping, and they defined and mapped so-called ‘land systems’—that is, areas or an area where there is a recurring pattern of ‘land units’, each with its own distinctive combination of topography, soil and vegetation. As many as 30 land systems were identified in the Buna–Kokoda area, for example.

The early CSIRO surveys undertaken in north-eastern Papua were not without difficulties. Postwar land survey techniques had been developed in the arid and semi-arid areas of northern Australia and adapting the methodologies in the early 1950s to the tropical climate, vegetation cover and mountainous terrains of Papua were challenging, and more so initially. Access was difficult and helicopter support was not used until later years. Another important limitation in the early years was the unsuitability over large areas of existing aerial photographic and topographic map coverage. New aerial photography had to be obtained. Additional challenges facing the two initial land surveys immediately following the 1951 Lamington eruption included the extensive ash cover on much of the landscape as well as the social impact of so many deaths. All of these challenges, and others, meant that the reports and coloured maps for the first two land survey sheets could not be published until 1964—that is, 10 years after completion of the surveys (Haantjens et al. [1964a] 2010a, [1964b] 2010b). Notable later successes, however, were also achieved by climatologists, including those from The Australian National University (ANU), in their provision of meteorological data compilations for the Territory and region—for example, for rainfall and wind (Brookfield and Hart 1966; Fitzpatrick, Hart and Brookfield 1966; McAlpine, Keig and Short 1975). These compilations were invaluable not only for the CSIRO land surveys themselves but also for later volcanological hazard assessments.

Several conclusions of volcanological and disaster management significance to the Lamington story can be highlighted from the final CSIRO report and maps for the Buna–Kokoda area. First, a clear age differentiation is made on the main accompanying map (Figure 9.1) between the young Lamington volcano in the west and the larger, but older Hydrographers Range in the east, unlike in previously published, coloured, geological maps up to this time (Figures 2.3 and 3.5).

Figure 9.1. Part of the CSIRO land use map

The width of the outlined box from this map by Haantjens et al. ([1964a] 2010a) is equivalent to about 22 kilometres from east to west and refers to the enlarged map shown in Figure 9.2. The southern edge of the Lamington volcano is outside the southern limit of the Buna–Kokoda sheet area (see Ruxton et al. [1967] 2010, however, who map this southern area but at a larger scale). One of the land systems, called Oivi (number 3 in the south-west corner), consists of ultramafic and mafic rock, which are illustrative of the close proximity of the volcano to the Papuan Ultramafic Belt and Owen Stanley Range. Reproduced with the permission of CSIRO Publishing.

Second, as many as 11 different land systems are numbered for a smaller area encompassing Mount Lamington and within the box shown in Figure 9.1. One of these, number 15, is called the ‘Ambogo’ land system, which is readily seen on the map by the several narrow, irregular strips—coloured in mauve—like streams escaping from the summit area. These are particularly noticeable on the northern and north-eastern side of the mountain, including along the Ambogo River itself, almost reaching the coast. One patch is actually at the coast, near Buna. This land system is described as a ‘complex’ consisting of 1) slopes made up of mudflow and pyroclastic flow deposits including those of the 1951 eruption, 2) a piedmont and flood plain and 3) a volcanic outwash plain. Many of these deposits occupy pre-existing valleys that are dangerous because

of the propensity of rapidly descending mudflows and pyroclastic flows to follow them, as experienced during 1951. The ridges or interfluves between the valleys, however, are not necessarily safer places during larger eruptions where widespread hot 'ash hurricane' may blanket much larger areas, as on 21 January 1951.

A third notable point is the mapping of numerous 'satellite', 'adventive' or 'parasitic' volcanic features on the western side of the mountain, as shown on a separate and more detailed map (Figure 9.2). Many of these minor features can be seen also on the oblique aerial photograph taken in 1947 (Figure 3.9). They are small, geologically youthful extrusions of lava that have formed domes and coulées, together with a few small cones probably made up of ash and other types of pyroclastic material. Note how many of these features are sited within a broad band running east-north-eastwards up the western flank of the volcano and encompassing the summit area, as shown by the two red dashed lines. This may define a zone of weakness on this part of the volcano where small eruptions can break out in different places, rather than from the summit crater alone. A rift-like zone of linear fractures can also be seen on the 1947 aerial photograph (Figure 3.9). Three adventive features on the lower south-eastern flank of the volcano, however, are not part of this zone. The geological history of the whole zone is unknown but these sites of satellite volcanic activity cannot yet be claimed to be major sites of explosive volcanism. They may, however, represent minor eruptive activity that is younger than the latest major explosive eruption at Lamington before 1951.

A fourth aspect of the CSIRO study of Mount Lamington is the determination of the times and rates at which different plant species recovered in the disaster area. This was potentially of more interest to volcanology in general, as it involved the dating of old areas of volcanic destruction where the precise age of the eruption may have been unknown (Taylor 1958). CSIRO plant ecologist B.W. Taylor gave particular attention to this aspect of the land use survey in 1953, visiting not only Lamington but also the previously devastated Papuan volcanoes of Mount Victory and Goropu volcano (Taylor 1957).

Figure 9.2. Land use ‘units’ in the Lamington area

Eleven different ‘units’ are distinguished in this map of the ‘Lamington’ land system (number 9) by Haantjens et al. ([1964a] 2010a), showing them in different colours and shades (compare with Figure 9.1). These were mapped relative to the limit of complete destruction of vegetation caused by the eruption of 21 January 1951 (the solid thick black line; after Taylor 1958). Numbers have been added to this adapted figure for only three of the 11 units as follows: 1) a ‘recent tholoid’ shown in red and referring to a) the central lava dome created within the summit crater in 1951–52 and including talus on its north-eastern side (the stippled area represents cloud and vapour from the still-hot tholoid seen on aerial photographs) and b) a ‘recent tholoid’ in the bottom left-hand corner that must be presumed to be older than the central 1951 lava dome; 2) coulées or thick, bulbous lava flows; 3) old lava domes and satellite/adventive pyroclastic cones. Note also that the feature in the bottom left-hand corner (see 1b above) is on fairly flat ground north-west of the Asopa airstrip and well away from the base of the Lamington cone. Compare this map with the digital elevation model image in Figure 10.1.

Finally, scientists from the CSIRO Cement and Ceramics Section in Melbourne tested the physical ‘pozzolanic’ qualities of ash samples from the 1951 eruption (Alexander and Vivian 1957). The scientists concluded that the ash could indeed be mixed satisfactorily with Portland cement in the production of concrete, perhaps for local use.

Ruxton on the Managalese Plateau

Another CSIRO land resource field team mapped the 'Safia-Pongani' sheet area south and south-east of Mount Lamington in 1963–64. Only the extreme southern tip of the Lamington cone itself is seen on this sheet area, but volcanic ashes from the volcano are found considerable distances south-east of the mountain. The ash cover 32 kilometres south-east from the Lamington crater is as much as 12 metres thick on the Safia-Pongani sheet (Ruxton 1966a). Such a thickness is an attraction to any geologist interested in reconstructing the life history of a volcano, and CSIRO geologist Bryan P. Ruxton took up the challenge, reporting widely on his findings (Ruxton 1966a, 1966b, 1988, 1999; Ruxton et al. [1967] 2010; Ruxton and McDougall 1967).

Ruxton was aware of the limitations of his published conclusions. First, the ash cover was not well exposed because of the extensive tropical vegetation. Many pits and auger holes had to be dug and sections along footpaths scraped away to reveal the ash layers, and only the upper sixth of the ash mantle was studied in detail anyway. The fine ash of the 1951 eruption was barely represented in Ruxton's study, much of it having drifted onto forest canopies and 'lost' in the underlying leaf litter of the forest floor. Ruxton also recognised that he was studying ash sequences on only one side of the volcano, and that sequences elsewhere, deposited by different winds, might be quite different. This is an important point as there is meteorological evidence from Port Moresby that winds higher than about 5,000 metres above sea level blow east to west all year round in Papua (Figure 9.3). This is in contrast to winds below 5,000 metres, which change from north-westerly during the 'wet' monsoonal season to south-easterly during the 'dry' season of south-east trade winds.

Ruxton (1966a) collected about 300 ash samples for later laboratory study of grain size and mineral content, but even these did not help greatly in distinguishing marked differences between the different ashes in any one section or between sections. Further, the ashes were weathered and coloured by oxidation of iron oxides in different degrees, inhibiting recognition of the deposits of individual eruptions. All of the ashes were of the air-fall type and none were recognised as having been deposited by pyroclastic flows. However, the presence of buried soil layers, signifying breaks in eruptive activity, were helpful, as were four radiocarbon dates on charred wood fragments.

Figure 9.3. Wind directions at Port Moresby above and below 5,000 metres

Wind data for the north-west monsoonal season from November to April are shown in this 'rose' diagram by the stipple and solid patterns respectively (de Saint Ours 1988; only the lower part of his fig. 4 is shown here). The meteorological data used are from McAlpine, Keig and Short (1975), and the extent to which they can be applied in detail to Mount Lamington is uncertain. The length of each sector is proportional to the time that winds blow in the plotted direction during this period. The numbers given for each sector are the maximum wind velocities given in knots (about 2 kilometres per hour) and the average wind velocity is given inside brackets. The wide fan-shaped and crosshatched areas represent the expected dispersion of air-fall ash, as suggested by de Saint Ours (1988).

Ruxton, despite these limitations, cautiously concluded the following:

1. Mount Lamington may have been inactive for well over 1,000 years prior to the 1951 eruption. This conclusion was on the basis of the age—supported by radiocarbon dates—of the youngest studied ash layer, the Silimbu Ash, which had 23 centimetres of topsoil developed on it. The conclusion needs to be qualified, however, because Ruxton did not address the possibility of younger ages for smaller eruptions whose deposits are more difficult to recognise, including those from the minor, well-formed, satellite volcanoes on the western side of the Lamington cone (Figure 9.2).
2. Each of three 'depositional units' in the upper-ash cover probably had durations of about 4–5,500 years, and separated by about 1,000 years in inactivity.

3. The character of the upper-ash layers corresponded to 'a discontinuous pattern of eruptive activity ... an alternation of series of closely spaced larger explosions and periods with much smaller explosions or quiescence' (Ruxton 1966a, 63).
4. The age of Mount Lamington as a whole is probably less than 110,000 years—most likely within the range of 80–100,000 years.
5. Explosive activity may have changed during evolution of the volcano as the result of a decrease in the proportion of eruptions producing ash fall deposits, together with a complementary increase in those producing pyroclastic flows. This conclusion, however, presupposes that ash falls from the distal parts of early pyroclastic flows are not represented in the sections studied by Ruxton.

Determining the 'periodicity' of catastrophic eruptions that produce deadly pyroclastic flows at Mount Lamington continues to be a major challenge for volcanologists today, and Ruxton's work still represents the only published attempt to find a practical answer that might be useful for disaster management purposes.

Ruxton in 1967 also visited an archaeological site at Kosipe about 140 kilometres west of Mount Lamington and 135 kilometres north of Port Moresby. The surface layers at the site were identified as weathered volcanic ash, four of which were the ash 'depositional units' that Ruxton had recognised and named previously on the Managalase Plateau south-east of Lamington (White, Crook and Ruxton 1970). The full sequence, however, could not be observed and there had been some observable local thickening and redistribution of the ash. Nothing further was concluded on the subject of eruption periodicity, but the work demonstrated the potential for integrated field studies of Lamington ash deposits in other parts of the area around the volcano. It also demonstrated how volcanic ash, if correctly identified as originating from Mount Lamington, could be deposited well to the west of the volcano from the high-level east to west winds even during the 'north-west' season of low-level winds (Figure 9.3).

The ashes of Mount Lamington were just one of the subjects of volcanological interest to Bryan Ruxton during the mapping of the Safia–Pongani area. Another was the nature of the youthfully volcanic Managalase Plateau to the south-east of Lamington where about 30 small volcanic centres were defined. One of these was Mount Manna, a small volcano that Ruxton suspected had produced ashes that had slightly

‘contaminated’ the Lamington ash cover he had been studying. Two other minor volcanic centres on the plateau were together near Kururi, close to Afore, where a small pyroclastic cone and nearby explosion crater were reported by Ruxton as having been ‘active in village memory’ (Ruxton 1966b, 351; Figure 9.4). The precise age of the eruptions is not known but the activity may have been between the two world wars, or possibly even roughly synchronous with the eruptive activity at Goropu volcano in 1943–44 (Ruxton 2007). Kururi’s name, then, can be added to the list of volcanoes in Papua known to have been historically active up to 1951—Victory, Goropu, Lamington and Kururi.

Figure 9.4. Kururi cone on the Managalase Plateau

This grass-covered pyroclastic cone is at Kururi in the western part of the Managalase Plateau (rephotographed from Ruxton et al. [1967] 2010, plate 9, fig. 2). B.P. Ruxton and K. Pajimans dug an auger hole on the summit of the volcanic cone but found only basaltic scoriae and no appreciable soil, consistent with the volcano’s youthfulness (Ruxton 2007). Reproduced with the permission of CSIRO Publishing.

More Colonial Research and Surveying

The second of the 15 map sheets to be surveyed by a CSIRO land resources team was the ‘Wanigela–Cape Vogel’ area south-east of Mount Lamington (Haantjens et al. [1964b] 2010b; Keig et al. 2019). This survey took place in 1954 but, again, the published report did not appear until 1964. The map’s area includes both Victory and Goropu, or Waiowa, volcanoes. Plant ecologist B.W. Taylor was part of the CSIRO team and he reported on ‘succession’ vegetation on what he called the ‘blast areas’ of both volcanoes and of Mount Lamington (Taylor 1957, 1964).

Taylor (1957) concluded that as much as 400 square kilometres of vegetation had been destroyed on Victory by its late nineteenth-century eruption, an area twice the size of the area of total devastation on Lamington in 1951. Four ‘land systems’ were mapped on Victory, reflecting different zones of vegetation, but little attention could be paid to studying all of them, and no follow-up surveys were undertaken that might have provided a longer time series of vegetation changes. The western slopes of Mount Victory had been referred to by Captain Moresby in 1874 as ‘open grassy and wooded slopes, which have all the appearance of English parkland’ (Moresby 1876, 276). These were likely to have been areas burnt regularly by the Orokaiva who appear to have abandoned this practice post-eruption, after which the area became invaded by secondary forest growth.

Another Australian Government geoscience agency, the BMR, was also involved in systematic postwar mapping in eastern Papua. This survey work was part of a regional geological program aimed at covering the whole of the Territory at 1:250,000-scale as a basis for mineral and petroleum exploration and resource assessment (e.g. Wilkinson 1996). The geological results published for the area incorporating Lamington volcano were rather unusual in that the volcano was seen to have been built up on part of a massive slab of crustal and upper-mantle rocks that formerly had made up the deep floor of an ocean (Thompson and Fisher 1965). These rocks had been thrust up by powerful tectonic forces forming the so-called ‘Papuan Ultramafic Belt’ (PUB), which makes up the towering barrier of the Owen Stanley Range (Davies 1971). Small pieces of these distinctively dark PUB rocks could be seen in the light-coloured deposits and lava dome rocks produced by the Lamington

eruption of 1951 (e.g. Taylor 1958). The PUB is known technically as an 'ophiolite' belt. It dips north-eastwards, possibly providing the sloping surface on which Lamington volcano was built later.

These broadscale geological or regional-tectonic relationships would form the basis for later discussions on why and how Lamington came to have grown at that particular place. In the meantime, one of the BMR geologists, Ian E.M. Smith, was taking a particular interest in all of the volcanic rocks, of different ages, in eastern Papua (e.g. Davies and Smith 1971). This included reporting separately on the volcanic geology of Mount Victory, results that complemented those obtained earlier by the CSIRO scientists (Smith 1969, 1981).

Figure 9.5. Volcanic features of Mount Victory

This map is based almost entirely on the map published by I.E.M. Smith (1981, adapted from his fig. 2).

Victory is a 1,925-metre-high, somewhat asymmetric, volcanic cone (Figure 9.5). In the late 1960s, its summit area was dominated by a small crater complex and three lava domes, together with some thermal activity. These volcanic features appeared to have been built against a larger, parabolic, south-east facing crater wall. Other lava domes on Victory

were found to the south-west and north-east of the summit on a line that extended towards Mount Trafalgar. ‘Thick fresh looking ash deposits’ were found in river valleys to the north-west and south-east, possibly corresponding to the ‘burning rivers’ noted by local people at the time of the late nineteenth-century explosive eruption (Smith 1969, 11). Eruptive activity likely continued into the early twentieth century, possibly at a time when lava domes, or a dome, were being emplaced and causing night-time glows that—like natural lighthouses—were seen by people on passing ships. The south-east-facing crater wall could be that of a debris-avalanche escarpment. The ‘Wanigela’ and ‘Kopwei’ land systems on Victory were found to consist of outwash fans of volcanic sands and gravel, and were best developed on the south-eastern side of the mountain (see map in Haantjens et al. [1964b] 2010b). Therefore, collapses of the volcano may have taken place preferentially in the same direction, although debris-avalanche deposits had not been recognised.

There are some notable similarities between Lamington and Victory volcanoes, even though little is known about their respective eruptive histories. Both are high, asymmetric, volcanic cones that have breached ‘crater’ walls facing the sea, together with fans of volcanic debris deposited preferentially in the same direction. Both volcanoes have numerous small lava domes, many of which are possibly restricted to defined zones on each mountain. Both have had apparently similar historical eruptions and both retained thermal activity for many years after their latest eruptions. These last points are the reasons why Dr Fisher (1957) included Lamington and Victory in Part V of the *Catalogue of the Active Volcanoes of the World including Solfatara Fields* published by the International Volcanological Association in 1957.

There are differences, however, between the two volcanoes. Victory is much further from the Owen Stanley Range. It also has numerous old lava flows that are more clearly recognisable on aerial photographs than at Lamington (Figure 9.5). Further, Bryan Ruxton thought that Victory was ‘a much less vigorous producer of ash fall layers than Lamington’ (Ruxton 1966a, 61). This was on the basis of only thin ash layers being preserved on nearby Trafalgar volcano (after Haantjens et al. [1964b] 2010b). Further, Ruxton did not recognise ashes from Victory in the ash-cover sequence he studied south-east of Mount Lamington, although identifying them would have been difficult.

New geoscientific staff from Australia began work at the Rabaul Volcanological Observatory (RVO) during the early 1960s. A seismograph and two tiltmeters for earthquake and ground-tilt recording, respectively, were installed 14 kilometres from the summit of Mount Lamington by the RVO in December 1960 at the Martyrs' Memorial School, now rebuilt at Agenahambo on the main Popondetta road (McKee 1976). Fairly regular inspections of the volcano were carried out during these years—some routinely, others in response to reports of increased vapour emission from the dome or other changes. Avalanching, explosions and changes to the height and shape of the dome had been noticed since 1955, and temperatures of over 300°C could be measured in some places on the dome. No unusual evidence was found, however, that Lamington was about to produce another eruption of the type seen on 21 January 1951. The dome not unexpectedly was cooling and changing slowly. An oblique aerial colour photograph of the dome was taken in 1962 by a *National Geographic* magazine photographer (Scofield 1962). RVO staff could use this exceptionally well-positioned and clear photograph for comparative purposes during their inspections (Figure 9.6; McKee 1976).

Figure 9.6. Oblique aerial view of summit area of Lamington

The summit lava dome in the avalanche amphitheatre of Mount Lamington is seen clearly in this photograph taken from the south in 1962 (Scofield 1962). Mild vapour emission is taking place from the top of the dome where there are small lava spines. Vegetation is now extensive on the outer flanks of the volcano, but less so on the lava dome and amphitheatre walls. Ingleby (1966) provided a description of the Lamington area as it was in 1966.

Other research personnel arrived in Port Moresby from Australia in the early 1960s. They were from the Research School of Pacific Studies (RSPAS) at ANU in Canberra, and they established in 1961 a New Guinea Research Unit (NGRU) (May 2006). This was not the first time that ANU RSPAS researchers had shown an interest in the Territory. The university had been created as a postwar venture in 1946 and three professors in history, geography, economics and related subjects from RSPAS visited the Territory on a reconnaissance trip between 14 October and 10 November 1951 (Spate, Davidson and Firth 1952). The aim was to explore potential areas of research that might be of interest to RSPAS. The three academics did not visit the Northern District and the Lamington disaster received very little mention, although one of the authors briefly listed 11 research topics, the eleventh of which was entitled 'Changes in the settlement pattern in the Mount Lamington area' (Spate 1952, 12–13).

NGRU research staff were mainly economists, sociologists and anthropologists, and their interests focused on indigenous land use, land tenure and relationships to monetary concepts that might underpin an economic future for the Territory once colonialism had ended. Substantial attention was paid to the Orokaiva in the post-disaster Northern District where there was already a history of cooperative movements, cash cropping schemes and economic development that had been deeply influenced by World War II (WWII) and by the disastrous Lamington eruption. Many reports on the Orokaiva were published in the NGRU Bulletin series (e.g. Crocombe 1964; Howlett 1965; Rimoldi 1966; New Guinea Research Bulletin 1966; Waddell and Krinks 1968; see also Newton 1985) as well as in university theses and published in peer-reviewed journals.

The first multiracial House of Assembly, a first parliament of elected members, met in 1964 (Downs 1980). Other important developments in Port Moresby included the start, also in 1964, of an Administration College and, in 1965, the creation of the University of Papua New Guinea (UPNG) (Meek 1982). New educational and political opportunities were being provided from this time onwards for Papua New Guineans at both institutions (Nelson 1972). The Administration College seeded the political influence of a progressive 'Committee of Thirteen'—Papua New Guineans who publicly proposed early self-government. The group had started out informally as the 'Bully Beef Club' but it led to the creation of the *Pangu Pati* (Nelson 1982). The future inaugural prime minister, Michael Somare, was a member of the 'angry Thirteen', and so

too was Trobriand Islander Elliot Elijah, the MBE awardee who had been recognised for his services during the initial disaster relief phase at Mount Lamington in 1951.

UPNG also fostered the intellectual development of post-Independence leaders. John Waiko, for example, a Binandere man from Orokaiva country, was one of the first graduates from the university. He later joined UPNG as a lecturer in history before entering national politics (e.g. Waiko 2003). Further, one of the first UPNG graduates in geology in 1977 was Benjamin Talai, a man from the Duke of York Islands east of Rabaul, who would later become the first Papua New Guinean to lead the RVO (Talai 2006).

Sumbiripa and Science

Revised mythologies

Important anthropological fieldwork of disaster management significance was undertaken among the mountain Orokaiva during the 1960s by Dutch-born Erik Schwimmer, an anthropologist based at the University of Oregon in the US. His fieldwork was part of a larger, international, comparative study being run by his university on cultural change and stability in communities displaced by disasters of one kind or another. Schwimmer's comprehensive and insightful publications represent an important benchmark study of the mountain Orokaiva 15 years after the 1951 eruption (Schwimmer 1969, 1973, 1977).

Schwimmer selected three villages for his study. First was Sivepe on the western slopes of the mountain about 11 kilometres from the summit. Its people had fled the eruption and been accommodated at Wairopi and Ilimo evacuation camps. A large Anglican mission complex was established after the eruption near Sivepe at Sasembata that included a school, church and hospital (see also Kettle 1979). The second study village was a 'control group' of people at Inonda who had neither evacuated nor been relocated as a result of the disaster. Both Sivepe and Inonda had been studied previously by land use researchers from the NGRU. The third village studied by Schwimmer was Hohorita, population 348, which was made up of survivors from the now decimated Sangara people. They had built a recovery village at Irihambo, but were ordered to leave it some years later because it was found to be situated on Crown land intended

for the settlement of Australian ex-servicemen. Hohorito was established in 1957–59 on the main road north-west of the former Sangara Mission Station. This involved abandoning the fine church they had built after the eruption at Irihambo and rebuilding another, less-impressive one at Hohorito (e.g. Schwimmer 1969, 1977).

Schwimmer introduced his substantial report of 1969 with the following words:

Mount Lamington has long had, to the Orokaiva people, a significance somewhat similar to that of Mount Olympos [sic] to the Ancient Greeks. It is the omphalos kosmou [centre of the cosmos] of Orokaiva myth: the origin of death, warfare, fire—and generally of all those cultural elements established by the transforming deities—are traced to the Mountain, while the division of the people into distinct language groups is likewise a primordial event that occurred on the Mountain. The departed spirits of the Orokaiva have their home there, headed by the first man to have suffered death, Sumbiripa, to whom all the activity of the Mountain is ascribed. Signs from Sumbiripa reach the living regularly, because at all times the Mountain has rumbled and sent forth tremors and smoke.

These facts appear clearly from the cycle of myths, centred on the Mountain, collected by me in the vernacular in 1966–1967. The cycle is far too elaborate to be explained as a recent development. It might, however, be argued that before the disaster of 1951, the omphalos kosmou was located elsewhere and that it has since been ‘relocated’ to Mount Lamington. (Schwimmer 1969, 5)

Four versions of the Sumbiripa-Kanekari legend were collected by Schwimmer from different communities who, however, were telling their stories 15 years after the 1951 eruption rather than before it. ‘Kanekari’ in these stories now means the ‘separation’ of Sumbiripa rather than ‘shut in’ as in the version of the myth recorded by Amalya Cowley in January 1951. All four versions deal with Sumbiri and his wife Suja—these are Schwimmer’s spellings of the names—hunting on the mountain for several weeks. The mountain, in three of the versions, begins to rise because Sumbiri, ignoring a taboo, had sex with his wife. Several crags formed on the angry mountain and the couple became isolated on one of them, from which they leapt into a ‘crater’ formed between the crags. Orokaiva historian Maclaren Hiari also recorded that ‘Sumbiri’—without the suffix ‘pa’—is the name of a tribal warrior from the Angereufu clan of the Songe tribe (Hiari 2013).

Figure 9.7. Drawings of the Sumbiripa myth by Maine Winny and Louise Bass

Post-1951 versions of the Sumbiripa myth are captured in these two drawings. The one on the left is by Maine Winny (Johnston 1995, 12). Sumbiripa and his wife Suja and their dog are trapped in a hole on the mountain. Attempts by villagers to rescue them, apparently using a line of cane, are frustrated by the hole becoming deeper as the mountain grows higher, and they perish. This version of the myth was told in some detail by Cedrick S. Mimari of Kendata Village in 1987, assisted by his nephew Winterford Poraripa (Johnston 1995). The drawing is reproduced here courtesy of the Johnston family, Melbourne. Villagers in the sketch on the right by Louise Bass are dropping food into the hole for the trapped Sumbiripa. This drawing accompanied a short version of the legend written in Orokaiva by Joel Oreba (1976, 5).

A version of the myth told at Hohorita, where Sangara survivors of the eruption now lived, deals primarily with a fight between a pig and a large dog, or dogs, during which the mountain became divided into different parts or peaks. The accompanying man and woman became separated on different peaks where they died of loneliness and despair. Schwimmer (1969) said that this version was 'the richest in mythological content' (6). It could also be said to have 'geological content', although the creation of crags, peaks and craters is not mentioned in versions of the legend told before 21 January 1951.

Pre-eruption mythology does seem to have evolved to something different and more substantial after the 1951 eruption. This is not all that surprising given, first, the massive damage, disruption and trauma imposed on Orokaiva communities; second, the need to explain the unexpected disaster with equally dramatic and meaningful stories; and third, the fact that any

one story depends also on who is telling a particular version of it. By the 1960s, the name Sumbiripa was prominent in many different versions of the myth collected by different people at different times (e.g. Wodak 1969; Schwimmer 1969; Horne 1974a; Oreba 1976; Newton 1985; Johnston 1995; Radford 2012; Larsen 2017; see Figure 9.7). Further, by the mid-1960s, 'Sumbiripa' was the name being given locally to the mountain itself, in place of 'Lamington' (e.g. Radford 2012; see also Figure 9.8).

Figure 9.8. Local names for Lamington peaks drawn on old milk label

Water vapour is seen rising from the summit of Mount Sumbiripa, previously known as Mount Lamington. This sketch was drawn in 1969 on the label of a powdered milk container provided by an Orokaiva landowner called Barnabas who used only local names for the numerous peaks. The diagram was provided courtesy of Mr John R. Horne. Mr Horne himself later added the roads in the foreground and the name 'Banana Ridge'. The sketch of peaks used on the title pages of each of the four parts of this book is based on the drawing shown here.

The statement made by Schwimmer (1969, 5) that 'at all times the Mountain has rumbled and sent forth tremors and smoke' perhaps carries a hint that the Orokaiva had always known that Lamington, or Sumbiripa, was a 'volcano'. The word 'smoke' in this context could easily be equated with actual eruptive activity. Schwimmer could not confirm this, however, and later wrote that 'before 1951, Sumbiripa was not known by Orokaiva to have ever erupted' (Schwimmer 1977, 321). Extracting scientific interpretations from powerful and strongly told myths after disasters can be a fraught exercise, but one can conclude in

the case of Mount Lamington that evidence of witnessed, undoubted, pre-1951 eruptive activity cannot be confidently obtained from the myths. Schwimmer himself was sensitive to such doubts when, in another context, he wrote that:

The history of anthropology is a history of questions asked by westerners and related to western intellectual preoccupations. One might well argue that even those anthropologists who collect folk-explanations and folk-philosophies are pursuing western preoccupations, inasmuch as they write up their findings in the context of western scientific debate. (Schwimmer 1976, 34)

Does all of this mean that the mountain Orokaiva had no pre-1951 knowledge of what ‘volcanic eruptions’ were in a general sense and, perhaps, no specific word for them or for ‘volcano’? Europeans were certainly aware that the Orokaiva treated the mountain with considerable respect and apprehension as the home of powerful spirits, as noted by Wilfred Beaver as early as 1913–14. The same local apprehension was also witnessed, for example, by the missionaries who climbed the mountain in the 1930s and heard ‘roars’ that, at the time, they could not explain. However, were the roars from the cascading waters of nearby torrents, or from more distant thunder storms, or from a small avalanche nearby, or from nearby earthquakes not related to the volcanic mountain? Before 1951, the latest major explosive eruption at Lamington may have been so long ago as to be ‘lost’ in cultural memory, but the same cannot be said necessarily about the smaller eruptions that are presumed to have created the geologically very youthful minor cones on the western flank of the mountain. These minor eruptions, speculatively, could have taken place within the last few centuries and, potentially, would be less vulnerable to cultural-memory loss.

The speculation by Schwimmer that ‘the *omphalos kosmou* was located elsewhere and had since been “relocated” to Mount Lamington’ is a tantalising one. Ruxton (1966a) concluded, tentatively, that Lamington may not have had a significant explosive eruption for about a thousand years before the one in 1951. To what extent, however, had stories about the powerful eruption at Mount Victory in the late nineteenth century infiltrated the cultural mores of the mountain Orokaiva in relation to their own stories about Mount Lamington and its ‘roars’? Did some mountain Orokaiva see and hear the Victory eruption and pass the story on to descendants? The Baigona or Snake cargo cult of 1912 began at the summit of Victory volcano and news of the cult was known to have

spread throughout much of Orokaiva country. To what extent also were similar stories about Victory distributed during the closely following and widespread Taro Cult (Figure 2.5). Did these stories carry with them accounts of the overwhelming fierceness of the devastating eruption at Mount Victory together with a derived understanding of ‘the origin of death, warfare, [and] fire’? Further, had the reduction of conflicts between Orokaiva groups and the construction of the road between the coast and Kokoda across the slopes of Lamington—Monckton’s ‘Yodda Road’ to the goldfields—brought about by the colonists provided greater opportunities for the sharing of information and stories across Orokaiva country?

The effects of the eruptions at Goropu in 1943–44 also must have been known quite widely by people in the Lamington area—and not just by Reverend Dennis Taylor and the concerned young Tufi cook at Sangara Plantation. People may have heard even about the minor volcanic eruptions at Kururi on the Managalase Plateau to the south.

Four explanations for the disaster

The dominant explanation for the 1951 eruption found by Schwimmer among the mountain Orokaiva was, not surprisingly, the anger of the mountain or of the mountain spirit Sumbiripa (Schwimmer 1969, 1977). The anger had been caused by loud noises—by disrespectful acts, such as grenades being thrown near the crater during the war and, after the war, Orokaiva, and especially the Sangara people, hunting on the mountain with newly acquired guns, thereby depleting the ready availability of meat.

A second version of this explanation noted by Schwimmer derives not from the mountain Orokaiva but from the coastal Yega people who were traditional enemies of the now decimated ‘inlanders’. This information was contained in an undated, unpublished account written by Fred Kleckham probably shortly after the 1951 eruption. The Yega said that the anger of the mountain was being directed at the Europeans as payback for the hangings of the Orokaiva at Higaturu in 1943. The mountain Orokaiva do not seem to have been predisposed to such an explanation, as it does not explain why thousands of them also had to perish in the eruption as collateral damage. The Yega explanation may have resided somewhere within a cargo cult that was prevalent in 1951. The cult appears to have been politically benign—simply a magico-religious means of acquiring the same European knowledge that yielded wealth not yet possessed by the Yega (Schwimmer 1977). Revenge aimed against the Europeans and

the tyranny of the hangings does not seem to have been an anti-colonial expression of the cult, although such a justification was warranted. A prophet at Buna also reported that before the eruption a coastal spirit had visited her and said that 'he was to be responsible for the eruption. He was ordered to come inland and blow up the mountain' (Opeba 1977, 228). A reason why the spirit had to undertake such drastic action does not accompany this very brief story.

A third explanation listed by Schwimmer is the now familiar one: that the wrath of the Christian but Jehovah-like God, rather than the anger of Sumbiripa, had caused the disaster because of transgressions by the Orokaiva. This was the dominant theme during the anthropological investigations undertaken in 1951 by Cyril Belshaw and Felix Keesing, neither of whom mention Sumbiripa by name in their separate reports. However, Christian Orokaiva interviewed by Schwimmer in 1966–67 were rejecting the wrath of God explanation as 'resting on a misunderstanding of the nature of God' (Schwimmer 1977, 317). The Anglican mission led by Bishop Hand and others must have made that point rather clearly following the 1951 disaster.

A general conclusion from Schwimmer's research was that the Orokaiva explanations, whether based on the anger of Sumbiripa, the Christian God or even the government, were consistent with a basic world view of the fundamental importance of exchange and reciprocity arrangements in all aspects of life (see also Schwimmer 1973). The Orokaiva would have believed that they had violated an agreement and, accordingly, that the volcanic disaster was a reciprocating punishment. Such a view is not all that dissimilar to Newton's Third Law of Motion: that for every action there is an equal and opposite reaction. Science, in fact, underpinned a fourth explanation for the disaster, but one that was held by only a minority of Orokaiva.

The fourth explanation is strictly geophysical: that volcanoes operate through natural laws that are quite unrelated to magical and religious beliefs. The Anglican mission itself put forward that scientific view after the 1951 eruption, which seems a rational and sensible step to take. However, according to Schwimmer, white planters and public servants claimed that the mission had been promulgating the false wrath of God explanation, and that now the mission was promoting the 'geophysical' explanation simply to counter that earlier criticism from the planters

and public servants. In so doing, Schwimmer (1977, 319) concluded that the mission's critics were 'pursuing obscurantist and reprehensible power politics'.

Those Orokaiva who accepted the geophysical view, rather than a magical/religious one, now could regard themselves as modern people, members of a new elite, holding enlightened opinions that were the same as those of the knowledgeable Europeans. How many of these new elite Orokaiva asked why the all-knowing and powerful Europeans had not interpreted correctly the geophysical early warning signs of the catastrophic eruption? Were the Europeans at Higaturu Government Station and Sangara Mission at fault for not providing an early warning that might have saved thousands of Orokaiva lives? The second question is answered affirmatively today by the Orokaiva and some speak bitterly about the failure of the colonial administration to evacuate people (Stead 2018). Conversely, at least some Orokaiva have said that senior staff of both the administration at Higaturu and the local Anglican mission had recommended an evacuation (Didymus 1974; Cowley and Virtue 2015). Such disparate opinions are part of a more complex situation of remembrance and opinion that depend on context (Stead 2018).

Attributing the volcanic disaster to generally articulated 'geophysical' causes is acceptable in a modern, secular-rationalist society, but were those causes well understood and, more particularly, to what extent are those causes understood even today? Fundamental questions of causation needed to be explained. Why did Mount Lamington grow in that particular place? Where, how and when does the magma form deep in the earth beneath the volcano? Where is the magma stored, if it is 'stored' at all, and for how long before a major explosive eruption takes place? What are the factors that control the frequency, size and timing of major eruptions? Does installing volcano-monitoring equipment at Martyrs' School help answer the question of how the volcano operates as an integrated geophysical system? Remarkably, a geoscientific revolution was taking place in the late 1960s that carried at least some potential to answer some of these questions.

The BMR established a geophysical observatory in Port Moresby in 1957 as part of a broad network of earthquake and geomagnetic recording stations covering the Australian region (e.g. Denham 1969). Mapping the location of earthquakes taking place in the Territory had not been easy because of a deficiency of seismographs in the wider region, but

this changed in 1964 when the World-Wide Standardized Seismograph Network (WWSSN) was established by the US. The WWSSN is used for the global monitoring of earthquakes and nuclear explosions. Improved earthquake mapping from numerous stations worldwide underpinned development of the revolutionary theory of plate tectonics that emerged in 1967–68 and whose impact became clearer during the early 1970s. The whole surface of the Earth is covered by tectonic ‘plates’—some large, others small—that move relative to one another along linear, earthquake-defined boundaries. Explosive, andesitic volcanoes such as Mont Pelée in the Caribbean, Mount Fuji in Japan or Rhuapehu in New Zealand were shown to be near zones where two plates converge and where one of the plates is ‘subducted’ or underthrust beneath the other. The passage of a down-going plate into the Earth’s upper mantle is tracked by increasingly deeper earthquakes. These were so-called ‘Wadati-Benioff’ earthquake zones, named after the seismologists who first identified them. Volcanoes that form above these down-going ‘subducting slabs’ typically produced magmas of andesitic composition, just like those of Lamington and Victory. The volcanoes related to any one subduction zone form long lines or ‘arcs’ parallel to the convergent plate boundary itself.

The Territory of Papua and New Guinea was demonstrated to have subduction zones, such as beneath New Britain and Bougainville Island. It also has numerous plate boundaries defining the margins of two major plates—named Pacific and Australian—as well as at least two minor, less well-defined plates sandwiched between them (e.g. Johnson and Molnar 1972). Both of the active volcanoes of Lamington and Victory are at the south-western margin of a ‘Solomon Sea’ plate where there is no active subduction (Figure 9.9). Rather, the earthquake zone here runs along or near the Owen Stanley Range including the large, near-vertical, Owen Stanley Fault and Timena Fault (Davies 1971). These and other vertical faults in the area were considered to represent evidence for pronounced uplift in geologically recent times, and to be associated with ‘block-faulted’ terrain such as Ruxton (1966a) had mapped in the Managalase area. Mount Lamington, therefore, was not conforming to the subduction zone model, meaning that generalisations about the behaviour of explosive volcanoes at subduction zones elsewhere could not necessarily be transferred to Lamington. Further, earthquakes may be felt, or heard, as roars in the vicinity of Mount Lamington that are of plate-tectonic rather than volcanic origin.

Figure 9.9. Plate boundaries in Papua New Guinea

The active volcanoes of Mount Lamington and Mount Victory are here plotted relative to the south-western margin of the minor Solomon Sea plate where no plate subduction is taking place currently (Johnson and Molnar 1972, adapted from fig. 2). This south-western margin is defined by uncommon tectonic earthquakes, many of which take place below the Owen Stanley Range. The short north-west pointing arrow to the east of Mount Victory refers to the same Solomon Sea plate boundary in the Woodlark Basin, which is where tectonic plates are moving apart from each other (see also, for example, Luyendyk, MacDonald and Bryan 1973). This version of plate boundary distribution in the Papua New Guinea region presented by Johnson and Molnar (1972) was the first of many to be published subsequently, not all of which, however, recognised the Owen Stanley Range as an active plate boundary.

Final Colonial Days

Inspections of the still-hot summit lava dome of Mount Lamington were undertaken by RVO volcanologists, and by others, in each of the years from 1970 to 1975 (McKee 1976). Some of these visits were in response to reports of increased volcanic activity at the volcano but all were identified as ‘false alarms’. The temperatures of gas- and vapour-emitting areas known as fumaroles were measured fairly regularly, and condensates of gases were collected at times (Crick 1973). Permanent instrumental monitoring of Lamington volcano was enhanced in June 1970 when a seismograph and telemetry station were installed on the north-western flank of the volcano about 2 kilometres from the summit dome, thus permitting seismic signals to be transmitted by radio to a recorder in Popondetta (Figure 9.10).

Figure 9.10. Seismometer and radio link equipment on Lamington in 1972

The equipment on Mount Lamington is here being inspected by an RVO field team in 1972. The photograph was taken by J.E. Zwartko. Photograph supplied courtesy of Geoscience Australia (negative number GA/5957).

The Lamington/Popondetta recording station was used in 1973 during a major ‘East Papua Crustal Survey’ undertaken by seven, mainly Australian, geophysical agencies, including BMR and ANU. The joint team used a total of 42 recording stations in a broad belt across the entire Papuan Peninsula to determine the crustal structure beneath Mount Lamington (Finlayson et al. 1976). Numerous artificial explosions were fired from ships at sea to the north-east (in the Solomon Sea) and south-west (in the Coral Sea), and the seismic signals were recorded at the land-based stations. The broad structure of the PUB as an area of

crustal thickening was confirmed, but the thickness of the crust beneath Lamington was found to be only 8 kilometres. Deeper structures, such as any seismically inactive subducted slabs, could not be determined by the survey.

Lamington was no longer in eruptive mode in the early 1970s, but other volcanoes in the Territory certainly were. Six volcanoes along the southern margin of the South Bismarck plate (Figure 9.9) were volcanically active during 1972–75 in a remarkable ‘time cluster’ of eruptions (Cooke et al. 1976). One of the six volcanoes was Manam Island, which broke out in eruption in May 1974 after a period of eight years of relative inactivity. Manam volcano always had been of strong professional interest to volcanologist Tony Taylor and, in 1972, he undertook a field inspection of the volcano. Tragically, Taylor died on the island on 19 August, apparently from a heart attack after returning from a climb towards the summit crater (Fisher 1976).

G.A.M. Taylor’s unexpected death in 1972 represented the end of a pioneering, postwar period for volcanologists working in the Territory of Papua and New Guinea. The imminent and inevitable end of the longer era of Australian colonialism was also becoming more obvious to indigenous people throughout the Territory, as well as to the Australian Government and the United Nations (e.g. Downs 1980; Meek 1982; Nelson 1982; Denoon 2005). Local ‘micro-national’ or ‘sub-national’ political movements emerged in different parts of the Territory, some of them espousing elements of separatism and local independence. The vigorous Mataungan Association, for example, was created in the Rabaul area in 1969, its political aspirations publicised when, in 1971, the European district commissioner, Jack Emmanuel, was murdered during what may have been a quite local misunderstanding and altercation. Two other examples are the Napidakoe Navitu political group, which represented the future interests of people on Bougainville Island, and the Papua Basena party, which was led by Josephine Abaijah, a charismatic activist who campaigned for Papuan separatism. The whole Territory took a major step towards its new status of nation-state when, in 1972, a national coalition government was formed. Its chief minister was Michael Somare, leader of the clearly nationalistic Pangu Pati.

Nationalist rather than separatist sentiments were being expressed at this time in the Northern District. Paulus Arek, who was born in Wanigela, had been the headmaster at the Popondetta primary school and, in 1968,

he nominated for the Ijivitari Open electorate (Langmore 1993). Arek won convincingly—and was re-elected in 1972. Arek had a forceful, outspoken and flamboyant personality, and was an ardent nationalist, serious-minded politician and trade unionist. He was sympathetic with the nationalistic views of the Pangu Pati but became a member of Julius Chan's People's Progress Party. Paulus Arek proposed in 1969 that an all-parties committee be established in Port Moresby to consider the constitutional development of a future self-governing country. The report of the 'Arek Select Committee' released in 1971 contained proposals for the structure of parliament and electorates as well as blueprints for self-government and independence (e.g. Langmore 1993; Denoon 2005).

The district commissioner of the Northern District at this time of political change was David R.M. Marsh. He had begun his service as the district commissioner in Popondetta in 1968 and had attended the opening of the Mount Lamington Memorial Cemetery in the town in 1952 (Marsh 2005–08). The significance and symbolism of the colonial memorial cemetery came under scrutiny during his time as district commissioner from aspiring leaders and other 'big men' in the Popondetta area. Marsh had to manage the situation as diplomatically as he could, not only on behalf of the administration, but also of the Australian Government, which was largely in favour of the resolute trend towards self-government and independence, more so after Gough Whitlam, leader of the Australian Labor Party, became prime minister in 1972.

None of the thousands of villagers killed by the Lamington eruption of 1951 were buried in the Mount Lamington Memorial Cemetery. Further, the burials there had been of bones disinterred by Sub-Inspector George Allen and then reburied at Popondetta in 1952, after a period in police storage. How were the remains identified? Some of the European bodies had never been found and the Anglican mission had buried its own European dead, so who was actually buried in the cemetery? The question was raised in Marsh's mind, and no doubt in others, of whether the park was, in fact, a memorial rather than a true 'cemetery'. Marsh made two decisions: first, to have the individual white crosses removed from the park; second, for the accompanying identification plaques at each of the former burial sites to be shifted to the centre of the park near the generic memorial plaque. These removals of personal identity would lead to unpleasant disputes several decades later, and to disaffection among

those European relatives of the deceased who wanted to visit grave sites in what had become an unkempt and deteriorating park (Marsh 2005–08; Speer 2005–14).

Self-Government Day was declared on 1 December 1973. Arek had died of cancer on 22 November 1973, just eight days earlier. Independence Day was celebrated on 16 September 1975.

One final contribution from the Australian colonial period—one that has disaster management significance—is a topographic map entitled ‘Popondetta’ that was published by the Australian military in 1974 for general use (Royal Australian Survey Corps 1974). The map is at 1:100,000 scale and was produced from triangulation surveys and from aerial photographs flown in 1973, supplemented by track and village information taken from patrol reports up to 1973. The volcano is named Mount Lamington rather than Sumbiripa. The value of the map rests in providing a benchmark record of settlement and infrastructure in the Lamington area, defining the layout of the road and track system and so on as they were in 1974 at the end of Australian colonialism. The map can also be taken as marking the end of the disaster recovery phase of the 1951–52 eruption but only in the sense that recovery and resettlement gradually migrate into future development strategies informed by the experiences of the past.

The old sites of the Higaturu Government Station, Sangara Mission and nearby villages are not on the map. Isivita is not shown either, but a foot track runs from Kendata on the north-western flank of the mountain down to Sasembata Mission, and a road then runs through Sivepe to the main road at Waseta. The main road along the northern side of the mountain eastwards to Popondetta has a string of settlements, including two villages at Awala, together with nearby Saiho where the hospital had long since been closed. The road continues eastwards through Soroputa to a larger cluster of buildings at Agenahambo, which includes St Michaels Mission and Martyrs School, and then on to Koipa and Hohorita School near the western side of Ambogo River. The road turns abruptly northwards, avoiding a river ‘double crossing’ at that point, and splitting into different parts near plantation blocks at Sangara, one road swinging southwards past the old, now disused, wartime airstrip that had operated during the disaster relief phase in 1951. The main road then runs up into the town of Popondetta itself, which is 20 kilometres from the summit of Mount Lamington and is now by far the largest of all the settlements in

the Lamington area. Roads head northwards to the coast, and one runs southwards through Jegarata before turning eastwards across the Girua River to Inonda and to Girua where a new domestic airport had been built. The road then runs past the Embi Lakes to the coast of Oro Bay.

The overall impression from the map is one of authorities and communities having learnt the lessons of the volcanic disaster of 1951. The northern, vegetated flanks of the mountain seem appropriately bare of settlement, despite the attraction of their volcanically rich soils. There are, however, minor signs of reoccupation beginning to take place. For example, Wijo Plantation, which was within the limit of total devastation in 1951, is shown on the 1974 map as growing rubber and cocoa, and tracks run upslope from it to a few houses on a creek draining from the higher parts of the volcano. Resettlement of parts of the devastated area had started already.

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